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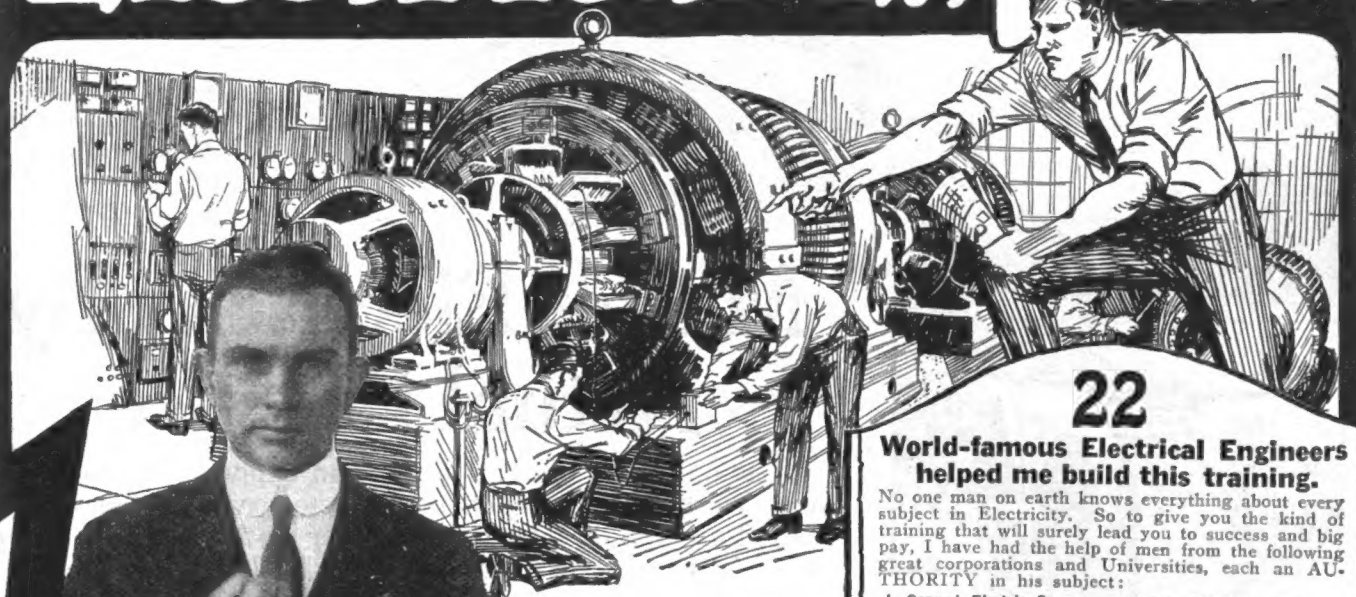

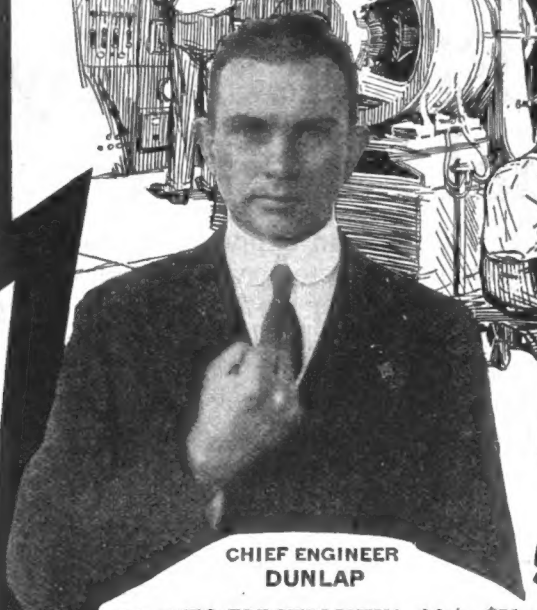

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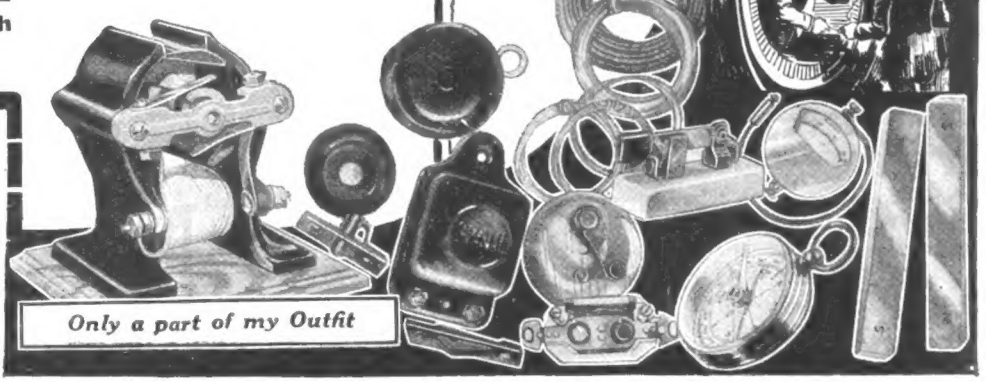

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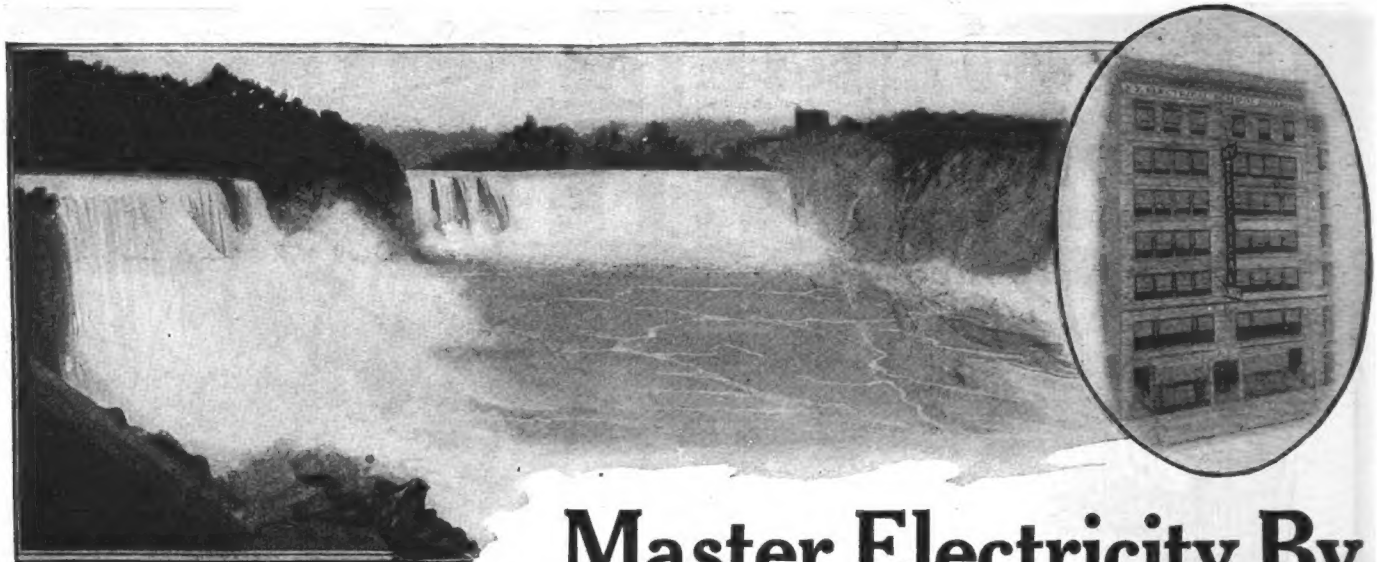

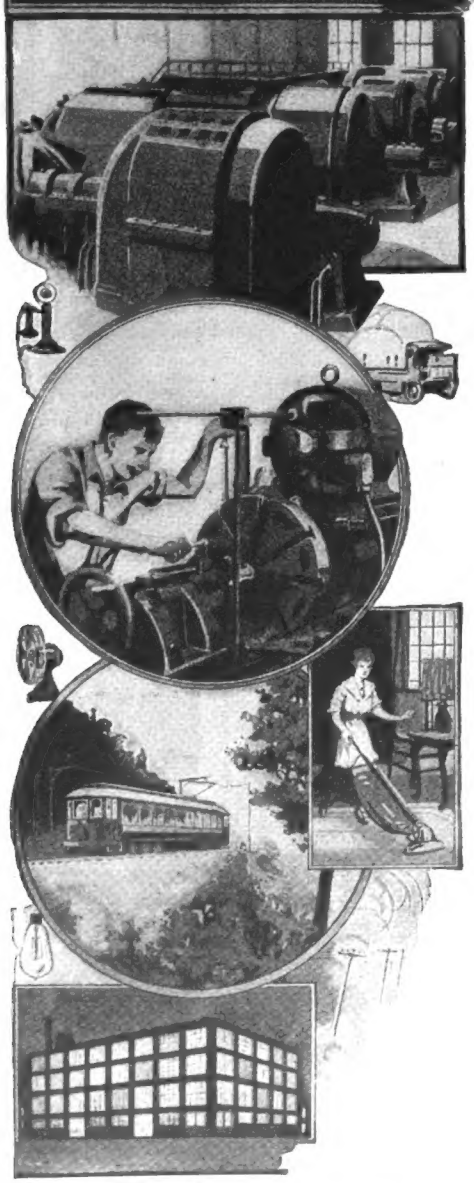

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Editorial and General Offices, - - - 53 Park Place, New York

"Those Who Refuse to Go Beyond Fact Rarely Get As Far As Fact" - - - HUXLEY

Airplanes vs Airships

By HUGO GERNSBACK

WHEN the writer visited Germany some years before the war, the Zeppelin airship was at the height of its renown. A number of these ships had been built and were making regular trips all over Germany. The writer remembers that at the time he was not impressed with these aerial monsters and so voiced his opinion to a prominent technician of Berlin, who became very much offended at the writer's deprecatory remarks. The war came along and the writer's opinion was vindicated in that the lighter than air machines proved too vulnerable and too difficult to control for the purposes of either war or peace.

I BELIEVE THAT:
Original thoughts are not necessarily the best ones.

The writer does not wish it to be understood that he thinks there are no uses at all for airships. There are many such uses, but he does not believe that the airship as we now know it will prevail in the future. In the first place the airship, even when filled with non-explosive helium, is too vulnerable for safety. A storm, while it can be weathered by riding it out, is often disastrous to the airship. This has been proven time and time again by German Zeppelins, many of which have been destroyed either by storm, lightning or explosion due to atmospheric electricity. The latter has not been mastered as yet. A modern airship is anywhere from 500 to 800 feet long and when flying at great heights is subjected to powerful electrical stresses. This is particularly the case when the airship rises or descends quickly. A huge electrical charge is accumulated by the ship and it often happens that sparks occur between the metallic members about the gas envelopes, causing any escaped gas to ignite and bringing down the airship.

I BELIEVE THAT:
Concentration on even a mediocre idea will often prove more valuable than an inspired invention.

But these are not the only drawbacks. Other and far greater ones are, first: the tremendous cost of the airship. Second—its slow speed as compared to the airplane (airships do not travel faster than 75 miles per hour, whereas airplanes can travel easily at 200 miles an hour). Third—The expense of operation as compared to airplane operating cost. Fourth—It is practically impossible to bring an airship down without using a mooring mast or a shed, whereas an airplane can make a landing very much more freely.

The only advantage for the airship today it would seem, is that it can hover over a certain point, an achievement which the airplane so far has not accomplished. But for war purposes, it is to be doubted, if the airship will ever be used to very great advantage. To do so would require a fleet of airplanes to protect the airship, because due to its slow speed it would easily become the prey of enemy planes. For that reason we require airplane protection for our airships, should we wish to use them at all, AND, if you have to use airplanes anyway, why use the airship at all?

An airship can be seen at much greater distances by the enemy, due to its huge bulk, while a scout airplane can disappear much quicker than any airship.

I BELIEVE THAT:
An ounce of experimenting is worth a pound of theorizing.

All this brings us to the question when we do travel in the air, as we certainly soon shall, how will we travel,—in airships or airplanes? From the above the writer is convinced that it will not be by airship. While we may see a period where for some years people with plenty of money will travel by airship, the commerce of the country will surely be moved by huge airplanes, which in size will not be far behind the present airships. We shall see airplanes 1,000 feet long and more with a wing spread of almost as much. No gas will have to be used in lifting such a machine. It will be propelled entirely by some form of propeller and sustained by wings. As such airplanes will travel at speeds five or six times as great as those of airships the cost of operation will be vastly less.

The present day airship takes ten hours or more to cover the distance from New York to Chicago, while the modern airplane can cover the same distance in about four and one-half hours. The economic factor alone will be the deciding one when in the future we begin to count operating costs.

But one of the worst drawbacks of the airship lies in the fact that the larger you build them the more difficult it becomes to obtain great speed, for the following reasons:

An airship travelling in calm air at 80 miles an hour naturally moves forward at this speed. If however it encounters a head-wind of 40 miles an hour it only progresses 40 miles although it is actually speeding at 80 miles. And the greater the bulk of the airship, the greater the power expended.

This is not the case with airplanes which are built along the principle of an arrow and cleave the air; thus they do not encounter so much friction; besides their bulk is much smaller.

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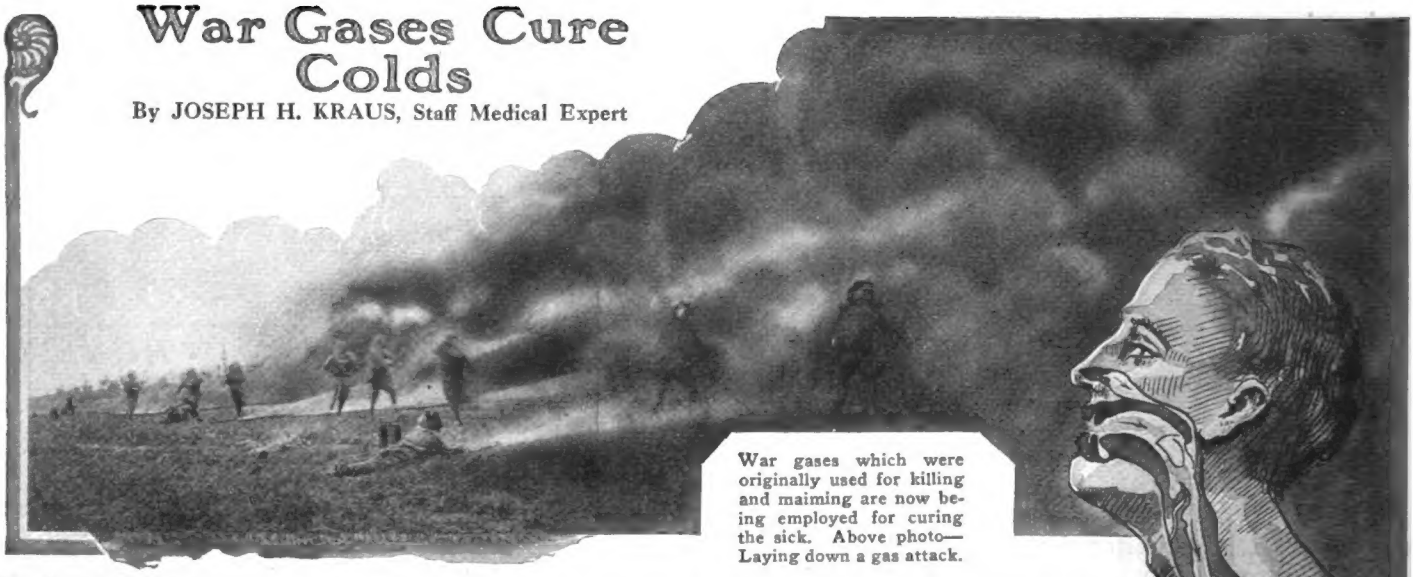
War Gases Cure Colds

By JOSEPH H. KRAUS, Staff Medical Expert

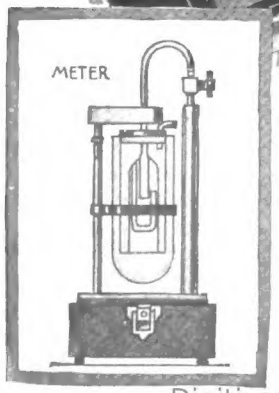


War gases which were originally used for killing and maiming are now being employed for curing the sick. Above photo—Laying down a gas attack.

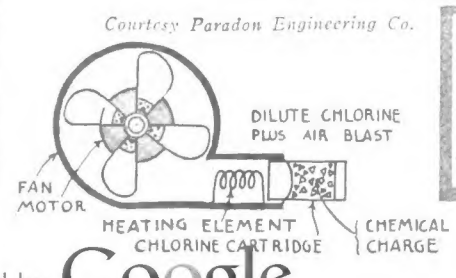
The photo below shows one of the methods in which the chlorine gas is administered to a roomful of people suffering from bronchitis, laryngitis and other diseases of the respiratory system. A tube from the chlorinator leads to the keyhole.

Infants and children feel no distress from the gas. The reason for the effectiveness of this treatment lies in the fact that the entire respiratory tract is coated with the gas.

The diagram on this page gives an enlarged view of the terminal alveoli (end cells) of the lungs. The two machines shown in photo at the left proved highly satisfactory during experiments made by the writer. The meter for measuring the gas flow is illustrated at the left.



Courtesy Paradon Engineering Co.



Two other types of machines are shown above and to the left. One operates by electrolytic decomposition; the other by heat decomposition.

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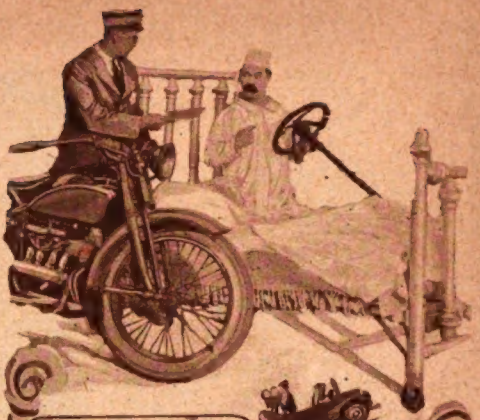
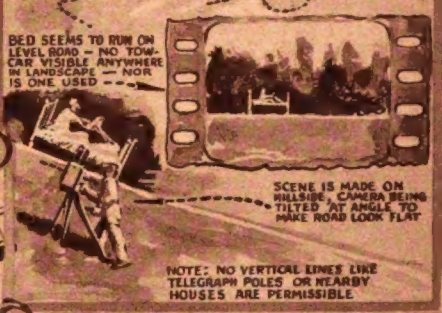
Comic Motoring in the Movies

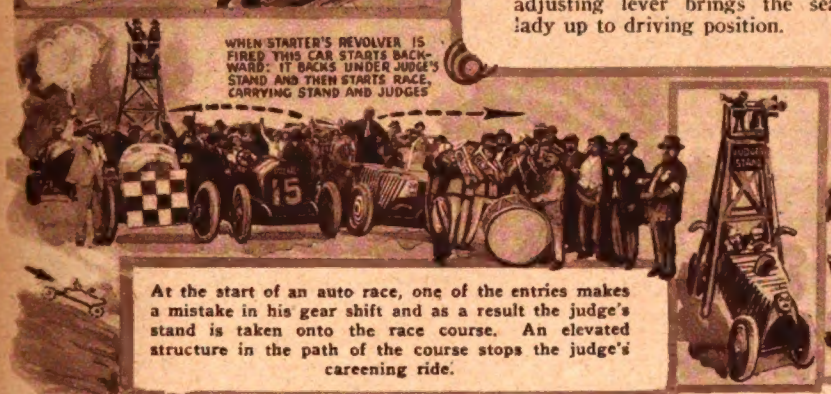
By W. B. ARVIN

All the antiquated automobiles of the western half of the United States must find a final resting place in Hollywood. At least that is the conclusion one logically draws after seeing the latest Educational Release, called "Lizzies of the Field." One of the most novel features of this picture is shown at the left. The enterprising garage owner is a terror with the ladies. He does away with the necessity of formal introduction by fitting his car with an extension seat which runs out on rods, gently lifting the lady of his choice from the sidewalk. A second movement of the adjusting lever brings the seat and lady up to driving position.

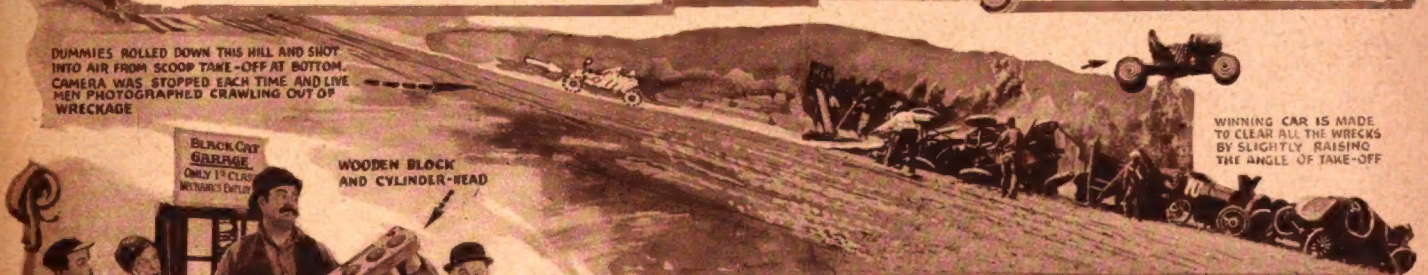



BED SEEMS TO RUN ON LEVEL ROAD — NO TOW-CAR VISIBLE ANYWHERE IN LANDSCAPE — NOR IS ONE USED
SCENE IS MADE ON HILLSIDE, CAMERA BEING TILTED AT ANGLE TO MAKE ROAD LOOK FLAT
NOTE: NO VERTICAL LINES LIKE TELEGRAPH POLES OR NEARBY HOUSES ARE PERMISSIBLE

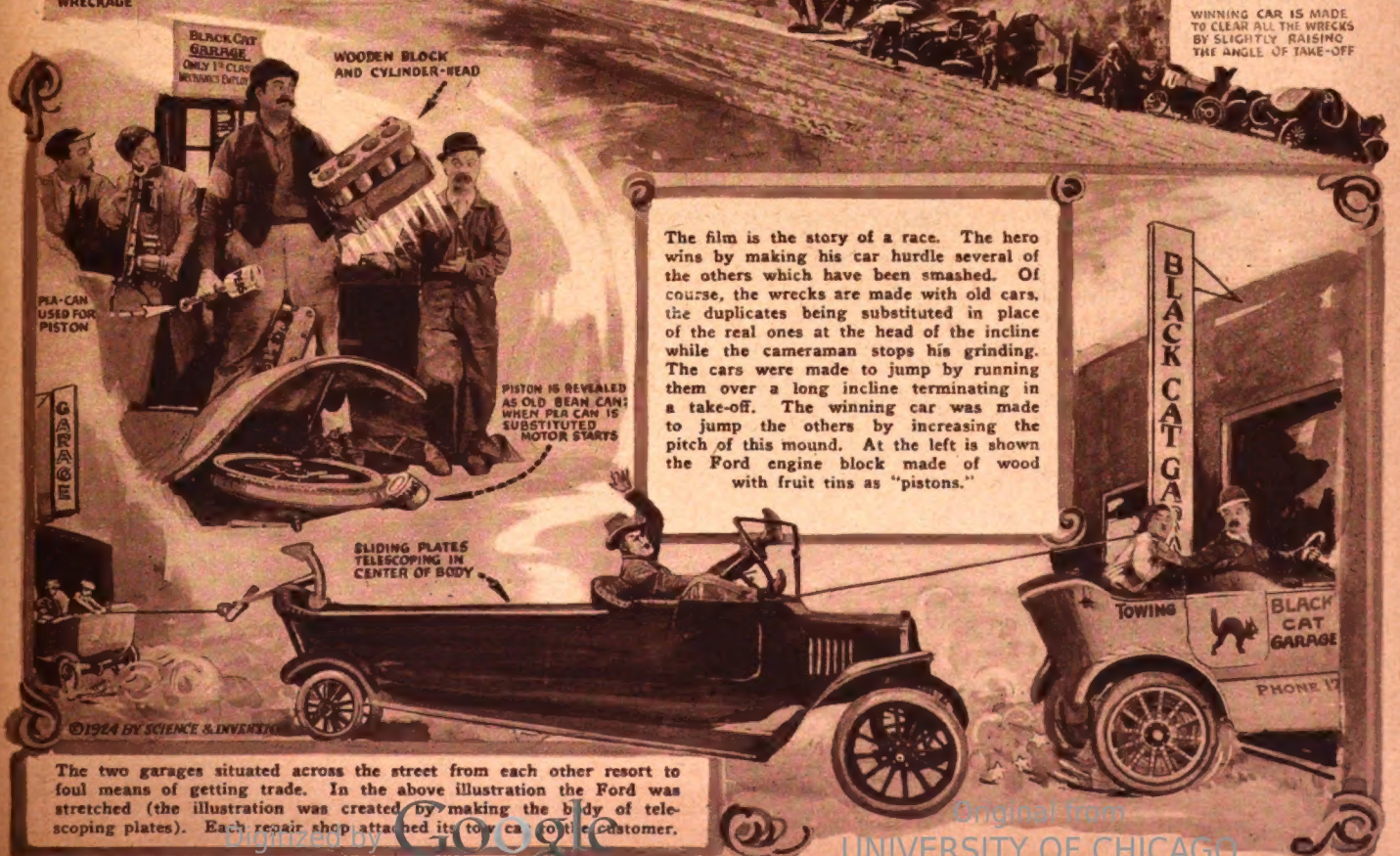
One scene shows the hero "bed" speeding. The stunt is done by towing the bed with an invisible wire and again by taking the picture with bed coasting down hill. The camera is tilted to make picture seem on level.


WHEN STARTER'S REVOLVER IS FIRED THIS CAR STARTS BACKWARD; IT BACKS UNDER JUDGE'S STAND AND THEN STARTS RACE, CARRYING STAND AND JUDGES
15
HITS ELEVATED RAILROAD; JUDGES GRASP STRUCTURE
DUMMIES THROWN DOWN

At the start of an auto race, one of the entries makes a mistake in his gear shift and as a result the judge's stand is taken onto the race course. An elevated structure in the path of the course stops the judge's careening ride.


DUMMIES ROLLED DOWN THIS HILL AND SHOT INTO AIR FROM SCOOP TAKE-OFF AT BOTTOM. CAMERA WAS STOPPED EACH TIME AND LIVE MEN PHOTOGRAPHED CRAWLING OUT OF WRECKAGE
WINNING CAR IS MADE TO CLEAR ALL THE WRECKS BY SLIGHTLY RAISING THE ANGLE OF TAKE-OFF

The film is the story of a race. The hero wins by making his car hurdle several of the others which have been smashed. Of course, the wrecks are made with old cars, the duplicates being substituted in place of the real ones at the head of the incline while the cameraman stops his grinding. The cars were made to jump by running them over a long incline terminating in a take-off. The winning car was made to jump the others by increasing the pitch of this mound. At the left is shown the Ford engine block made of wood with fruit tins as "pistons."


BLACK CAT GARAGE
ONLY 1st CLASS MECHANICS EMPLOYED
WOODEN BLOCK AND CYLINDER-HEAD
PEA-CAN USED FOR PISTON
PISTON IS REVEALED AS OLD BEAN CAN; WHEN PEA CAN IS SUBSTITUTED MOTOR STARTS
GARAGE
SLIDING PLATES TELESCOPING IN CENTER OF BODY
BLACK CAT GARAGE
TOWING
BLACK CAT GARAGE
PHONE 17
©1924 BY SCIENCE & INVENTION

The two garages situated across the street from each other resort to foul means of getting trade. In the above illustration the Ford was stretched (the illustration was created by making the body of telescoping plates). Each repair shop attached its tow car to the customer.

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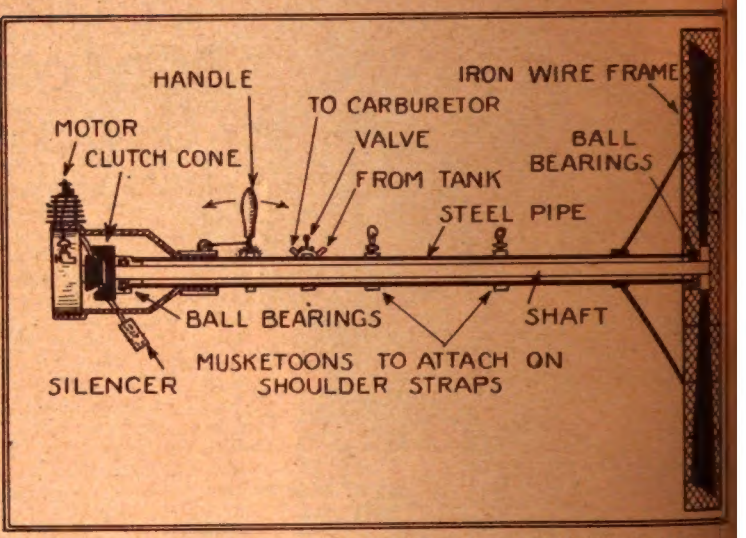
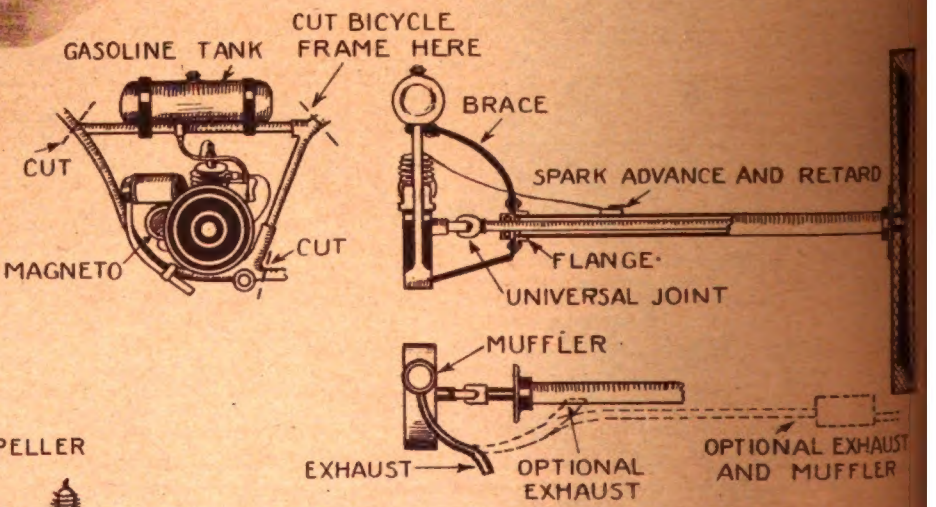
The Motopeller

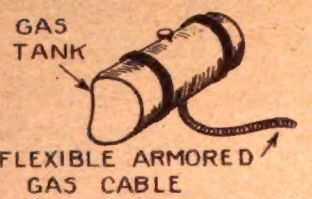
By P. C. v. PETEGEM, OF ROTTERDAM, HOLLAND

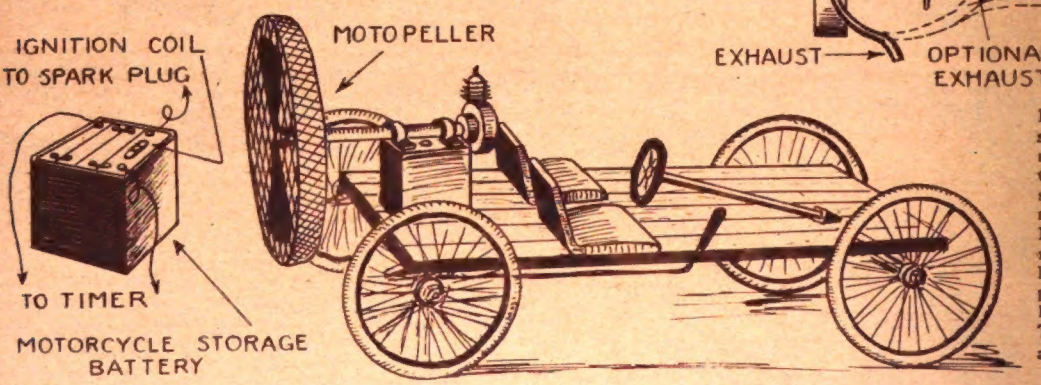
The above photograph shows a Motopeller that has actually been built and which gives excellent results. A three foot propeller is used in connection with a 1½ horsepower gasoline engine.



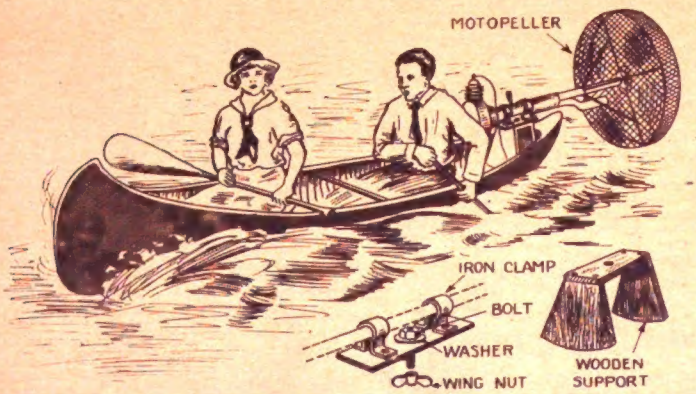
All of the necessary constructional details for making a practical Motopeller a shown in the above cross-sectional diagram. Dimensions may be varied to su



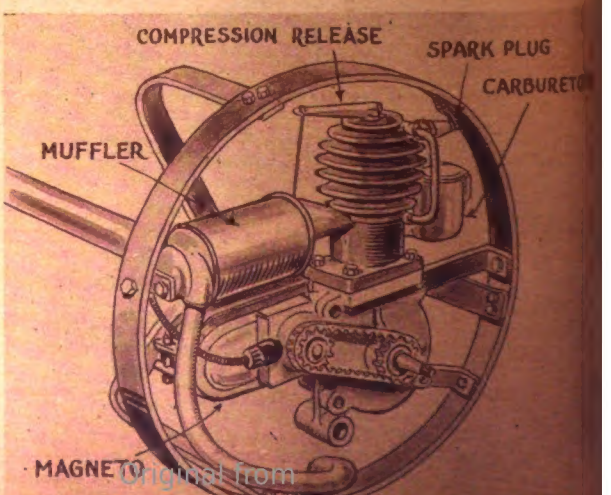




Directly above is shown how a standard light weight motorcycle may be used in constructing a Motopeller. The frame is cut off as shown and used to support the motor as well as the drive shaft. Below the motor are shown optional methods of placing the exhaust, allowing it to run through a hollow propeller shaft, alongside the shaft housing, or to the side of the motor. The latter is the simplest method although it throws the gases toward the operator when skating.



The Motopeller may be used for skating, or it may be placed on a small wagon or in a canoe. All these methods are illustrated above. At the right is shown a close-up of a completed Motopeller.



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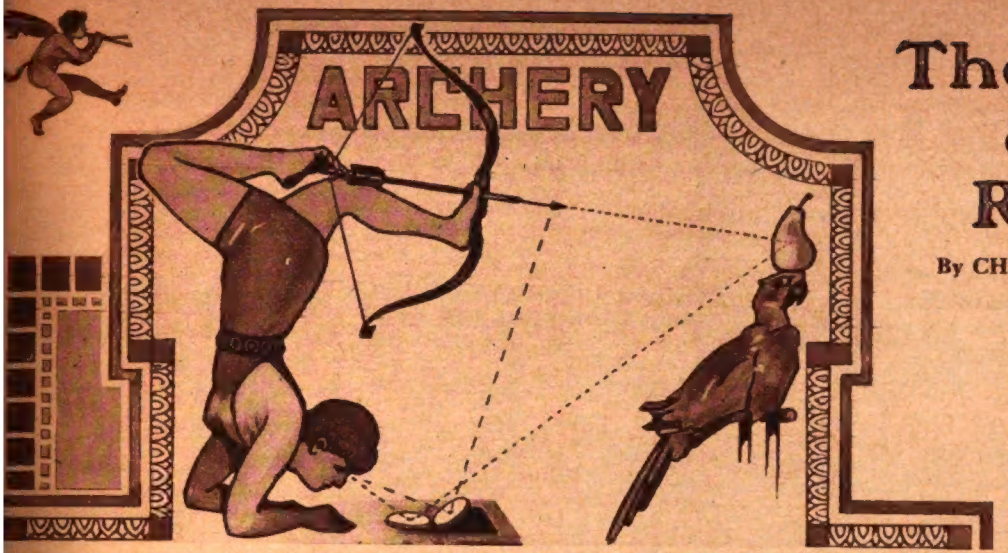


The Science of the Romans

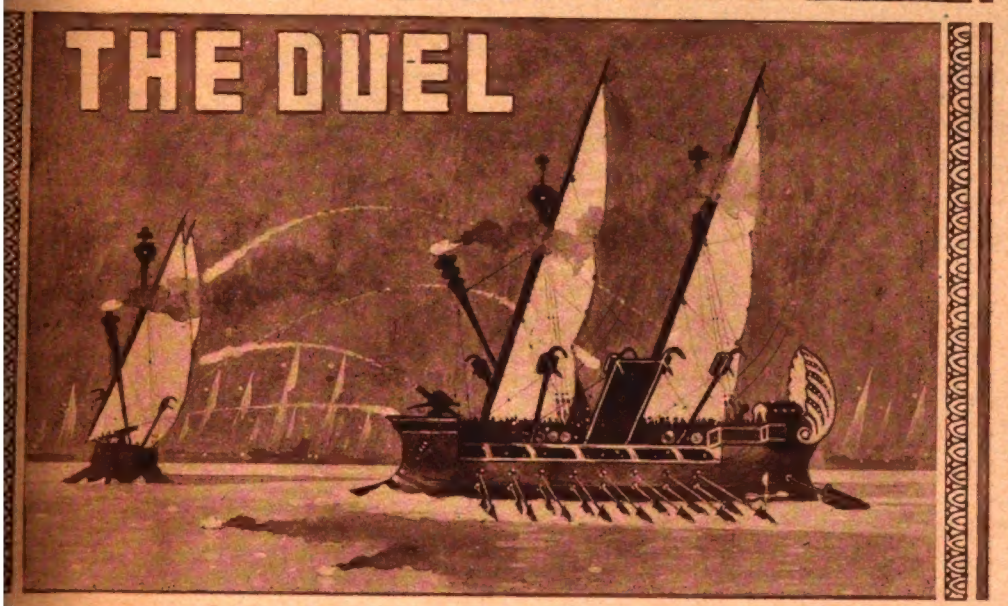
By CHAS. BEECHER BUNNELL

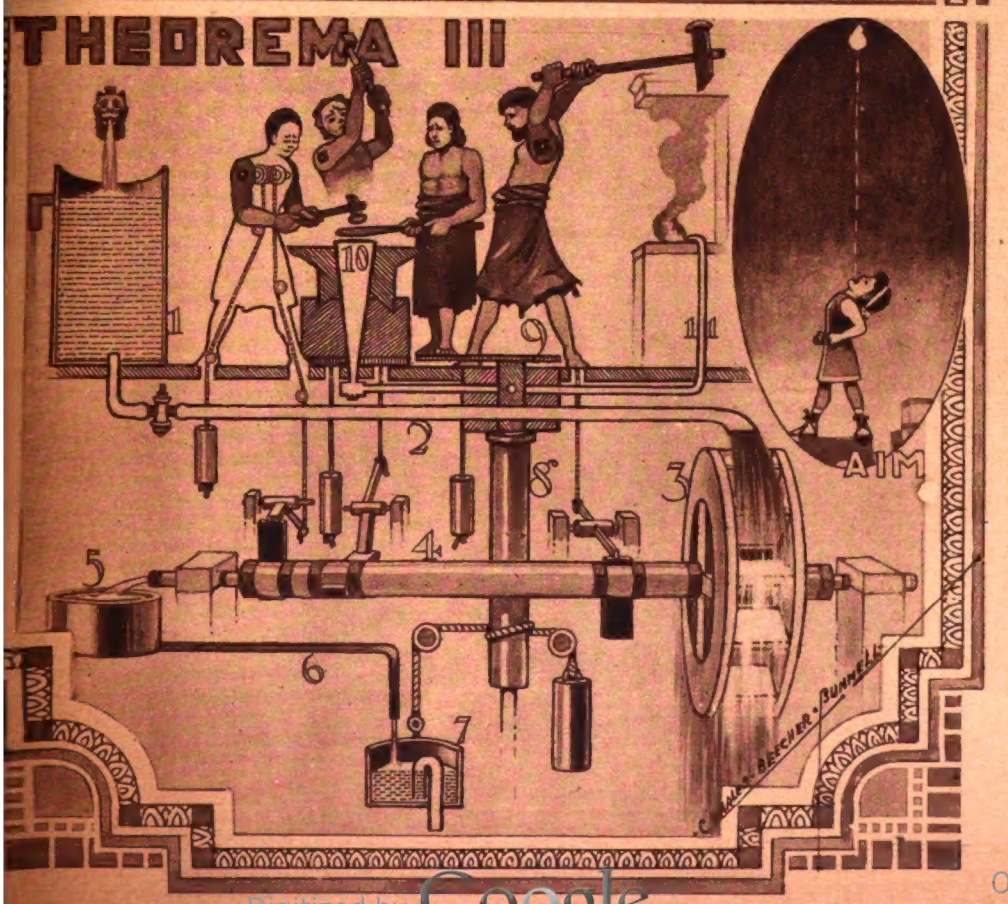
Illustrations by Author

THE ROMANS through scientific knowledge, whipped Europe. In their amusements this knowledge made their games interesting and popular.

Archery always attracted attention in the street or circus for it was genuine skill. In our illustration one of those experts aim with speculums—really a range finder and when the pear and arrow head appear simultaneously in the centers of each glass the aim is correct.

In our second illustration we show an enemy's captured ships condemned to fight together to amuse the conquering Roman fleet. One ship or its crew must annihilate its adversary. Their war speed is supposed to be relatively high, of course it lasts but for that hour and a quarter—then it relapses into eight or so knots after that. But most battles are decided inside an hour and a quarter.





Theorema III was an automatic smithy showing half life sized figures heating and hammering an iron bar. In operation water tank 1 through pipe 2 supplies water to water wheel 3, which turns hollow shaft 4, having three cams that actuate tappets connecting to each one of the three hammer men that work by an interior pulley and counterweight as shown by the man at the left. Some water from wheel is passed through the hollow shaft 4 into tank 5 that through pipe 6 supplies the siphon pail 7 in operation. When water reaches up to the siphon bend the water then rushes out; the counterweight, pulls the pail 7 up, turning shaft 8 one half circle. At 9 is an Archimedean hook on which a man who holds the iron is fastened. Below Fig. 9 is a two way cut-off valve—one controlling the water flow, and the other controlling the compressed air from tank 10, by way of pipe 11. The valve opens when the shaft turns the man iron-holder to the fire, letting the compressed air escape through pipe 11, which blows the fire.

Aim, the son of a Roman Emperor, became very proficient in all athletics. Among other things he found that it must be extremely difficult to throw a vertical object, then catch it again without leaving one's position. He became such a juggler, that he could throw up a pear or plum and catch it in his mouth. While exhibiting this feat with a pear thrown to a splendid height, it came down again exactly in the mouth—but it did not stop there—it went down the windpipe—and he died before he could be helped.

Horse racing was extremely popular for its element of danger. In the chariot races the reins were fast to the jockey's belt—and he had to carry a knife ready to cut the reins. Paintings in Pompeian house walls show babies racing a Biga and two horses; also bare back riding, while the tread-mill tow boats also appeared in aquatic races, for fleet amusement.

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The LIVING DEATH

By JOHN MARTIN LEAHY

THIRD INSTALLMENT

"It is Paradise, murmured Hampden. "Yes—it is Paradise that you have discovered—great Lord, here in the very heart of this frozen continent."

SYNOPSIS

The story opens with Captain Livingstone, imploring the aid of Darwin Frontenac, a famous scientist who has recently discovered methods of inducing hibernation in mammals. The Captain wants Frontenac's help in connection with a discovery he made during an exploration trip to the Antarctic. Before the Captain launches into his story leading up to the final details concerning the exact help he wishes, Frontenac revives a fish which has been frozen several days in a bucket of water, bringing the fish back to life. Several times in his plea the Captain has mentioned "her," also it is known that he wishes Frontenac's assistance in connection with his knowledge of the hibernation of mammals.

The Captain surprises Frontenac by making further statements relative to life in the Antarctic. The Captain says that certain discoveries that he made during his trip confirmed his beliefs that at one time the Antarctic was tropical and peopled by human beings.

The Captain goes on with his story of his trip. He tells Frontenac how his ship started toward the South, approaching the pole from the opposite side of the pole from the path of Amundsen and other explorers. At latitude 76°, land was sighted and followed for several days. A channel opening into the land was followed and the temperature of the water found to be 39° F., although the air was —28°. Some time later, the water temperature rose to 44°. Landing, one of the party explored some of the territory and found a carved column imbedded in the ice. Proceeding further, to latitude 85°, they established a depot, and at this point birds were seen. From this depot they start with dog teams inland, the temperature being 22° below zero. Reaching an altitude of 4,200 feet, the temperature is found to have risen to 6°. Proceeding onward. . . .

"Hampden . . . stepped into the sunlight . . . and stared like a man transported to fairy land. He uttered a cry . . ."

CHAPTER VIII

THE GARDENS OF PARADISE

"THAT,' I told Hampden, 'is just what I have been wondering myself.'

"The others were gazing in astonishment and in awe.

"'A dream?' said Thompson. 'No, it isn't a dream, because I have just pinched myself and proved that I was never wider awake in all my life.'

"'It *is* a dream,' said Wilkie, 'a dream that is *true*.'

"'It is Paradise,' murmured Hampden. 'Yes, Captain Livingstone, it is Paradise that you have discovered—great Lord, here in the [illegible] heart of this frozen continent!'

"And he reached out his hand and wrung mine. Then they all broke out cheering, and the other three pressed forward to shake my hand, and they all said that I had made the greatest geographical discovery of modern times and that they thanked God that they had been fortunate enough to be there with me.

"I am afraid that I became rather foolish then—yes, I admit it: try as I would, I couldn't keep the tears from my eyes. All I could do was curse myself roundly for a silly old femmelette.

"'Look at the dogs!' said Thompson. 'The blamed beggars! I know now why they sniffed and sniffed and acted so darned mysterious.'

"The dogs were looking and looking, and there was a great waving of tails in celebration of our wonderful discovery.

"'Paradise,' I said. 'That is it, Hampden: its name is Paradise—the Gardens of Paradise.'

"'It certainly looks it,' said Bogardus.

"And it certainly did.

"Perhaps, indeed, the contrast added to its loveliness. but I am by no means sure that this was so. For days, for weeks, we had been toiling through an indescribable waste of snow and ice and barren rock, and then suddenly to step out of that fog curtain and see this! No marvel, forsooth, that we had wondered if it all wasn't only a dream.

"The air was not perfectly clear. At first sight, it seemed so, but soon one noticed that there was a strange dreaminess over everything, so to speak. It wasn't a haze. I don't know what it was. It reminded me, more than anything else, of these strange and wonderful effects that one sees in some of the greatest paintings of Turner. And yet it wasn't *that*, either. Also, everywhere, the air seemed to be without movement. And the cloud effects! They were not grand or gorgeous, 'tis true, but they had a beauty that no painter has ever yet succeeded in placing on canvas. There were clouds like those that must float over fairyland.

"We did not look out upon the scene but down upon it, rather. I may liken the Gardens of Paradise to the bottom of a huge bowl, a deep plate would be better; the lofty, terrible mountains—running away in a great majestic arc, there to the right and to the left, until they were lost in the distance—forming the sides and the rim. The grand depression, however, must not be conceived of as a circular one. It was oval rather—that is, this part of it over which our eyes could range. There was no telling, though, what form it took away over there in the northeast—we had come out upon the southwestern edge—or to what distance the wonderful and mysterious land might extend in that direction.

"Before us, the ground—the snow, I should have said—fell away, now in great undulations, now in broken swells and jagged pitches. And down there, probably two miles from the spot where we stood, the snow suddenly ended. There trees grew in scattered and ragged patches—looking like pines, like weary, brooding sentinels. Then the ground sloped, down to great clumps and masses of trees and down and down until every swell and hill and plain was a mass of lovely green. Here and there

"There, not fifty feet from the spot where we stood, lay a head—a severed human head."

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streams were to be glimpsed, and there, off to the left, almost hidden amongst the swelling, rounded hills—a formation characteristic of these Gardens of Paradise—a lake mirrored back the blue and mauve and gold of the Antarctic sky.

"And there, far away, in the very midst of all this green and blue and dreamy, weird beauty, a great mountain towered aloft—its flanks for some distance up dark with trees and jutting rock, and then suddenly the region of perpetual snow. The summit of this great peak was lost in the clouds. The crowning one was of a curious shape, something like a mushroom, and it shone with colors so bright (and they seemed to flicker a little) that we wondered if that mass and color were not due to volcanic fires.

"Yes, there they rolled away for mile on mile, rolled on for league on league—the Gardens of Paradise. Altogether, a stranger and lovelier sight the eye of man has never gazed upon, nestling, as they do, in all their luxuriant and tropical beauty, there in the very heart of this frozen, desolate, lifeless Antarctic—in the midst of a land of unnamable loneliness, desolation and icy horror.

"Yes, and see them! There they were plain as plain could be in our powerful glasses. Look, there were palm-trees!

"'Palm-trees!' Thompson exclaimed. 'Captain,' said he, 'do you see any bananas?'

"I told Thompson that we might find things down there stranger than bananas and handed him the glasses so that he could see those palm-trees for himself.

"'I'm not surprised,' said Thompson. 'I'm beyond that now. I wonder, though—'

"He waved a hand towards the Gardens of Paradise.

"'Eden,' said he, 'had its serpent. I wonder if this Paradise has got one, too.'

"'We'll soon learn that,' I told him.

"'What I don't understand,' said Bogardus, 'is how on earth those trees and everything can *be*. Be!' said Bogardus. 'Reason tells me that the thing is impossible—absurd. And yet there they are! See 'em!'

"Hampden gave him an odd look.

"'Then so much the worse for reason,' Hampden told him. 'For, after all, what is there so very strange about it?'

"'Strange?' echoed Bogardus, staring.

"And I confess that I stared at that myself.

"'Why,' said Bogardus, 'the heat, for one thing. Here we have warmth and vegetation, even palm-trees, and all roundabout, for hundreds and hundreds of miles, nothing but snow and ice. Well, bless me, Hanner, if that isn't strange, then I don't know what on earth the word strange means.'

"'Oh, the thing is strange all right,' Hampden told him. 'That wasn't just my meaning. What I meant was that there is nothing mysterious about it. There is the warmth of Summer Haven; this is on a grander scale, that is all. Both are simply due to volcanic fires.'

"'Yes', said Bogardus, 'but how does it come that this warmth lingers here and trees are growing? Why doesn't the cold air keep coming in, the way it does there at Summer Haven?'

"Hampden smiled a little and pointed up towards the mountains.

"'There's the reason. They rise up all around, a veritable wall—at any rate, as far as we can see. This wonderful basin is mountain-locked. Virtually, the only way the heat can escape is by radiation and convection.'

"'How beautiful and simple!' exclaimed Bogardus. 'I thought of those mountains forming a wall all around; but all the same it strikes me as a mighty queer thing, let me tell you. And here's something else:

"'Look at those streams, look at all this snow that must be melting and sending down water all around and all the time. Why isn't the basin filled to the brim? And suppose that the water flowed out; what them? It would be frozen as fast as it flowed, and keep piling up and up.'

"'It would,' said Hampden, 'but you see that it doesn't. The water flows away to the sea by some underground channel, that is all.'

"'How simple and beautiful!' exclaimed Bogardus. 'And how warm it must get going through these rocks! And tell me something: how is Captain Livingstone going to make the world believe this? I've got a good big enlarged tintype of them whooping and hollering when he begins to tell them about those palm-trees that he discovered far inside the Antarctic circle.'

"'Won't we be there,' demanded Thompson, 'to back him up if any of those gents waxes skeptical?'

"'Pooh!' said Bogardus. 'They'll say that we all got moonstruck or something or were all lunatics to begin with.'

"'There are the cameras,' put in Hampden. 'Photographs will convince them, if nothing else will.'

"'Photographs? Not those birds. They'll say that the pictures are fakes.'

"'Oh, cheer up, Trophonius,' smiled Hampden. 'The world isn't so bad as you think it is.'

"'Cheer up? Oh, I'm cheerful!' said Bogardus. 'I know something of the world, too. And you mark my words: Captain Livingstone is going to have a time of it when he gets back and begins to tell about these things.'

"'There are the cameras,' said Hampden. 'Photographs will convince the last Doubting Thomas of them all. And so we'll begin right now.'

"And he did. He got out his camera and photographed us there in the place of discovery and photographed the mountains and the Gardens of Paradise.

"And then we started down, all eager to reach the snow-line, to walk on grass and hear once more the sounds of running water.

"Alas, why can't man see into the future? Because, I suppose, it wouldn't be the future if he could. There we were hurrying down the snow towards the Gardens of Paradise; but—if we had only known what was going to happen down there!

"There, incased in the ice . . . plain and yet as though seen through a misty glass, the face within six or eight inches of the edge . . . lay the body of a very young woman!"

"God in Heaven," Hampden cried, "She isn't dead."

CHAPTER IX

THE HORROR IN THE PALM-TREES

"I scarcely know how to tell it—this horror and mystery that awaited us. Certainly I have no desire to minimize any part of it, if for no other reason because you should know truly what awaits any man who makes his way into the Gardens of Paradise.

(Continued on page 822)

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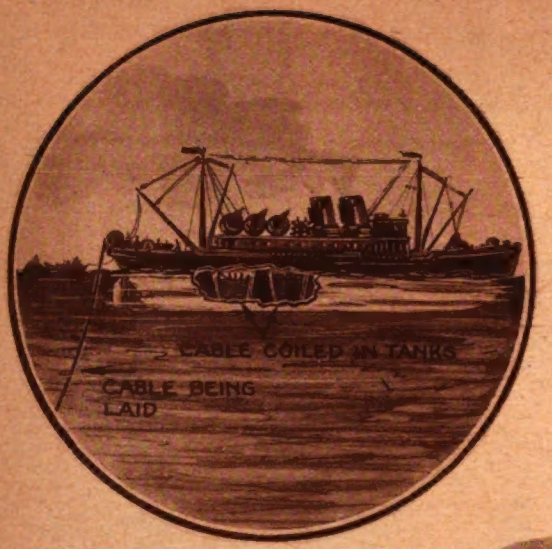
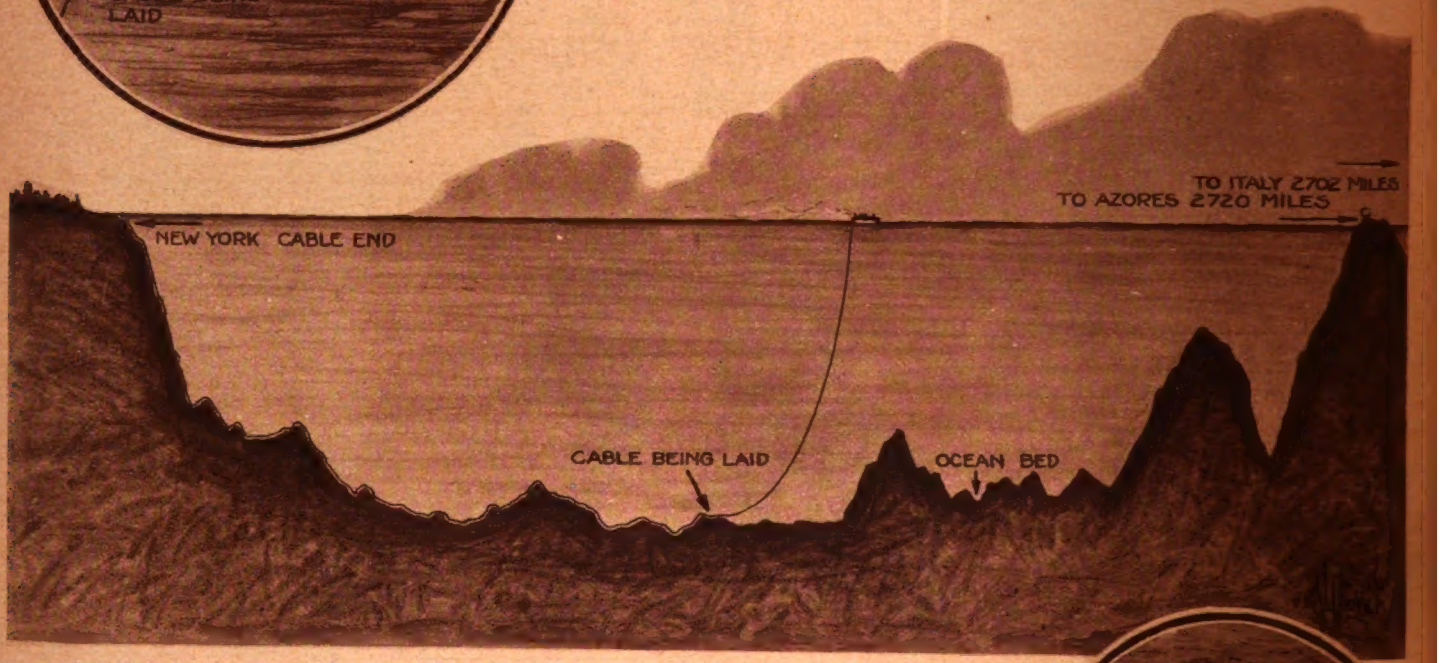
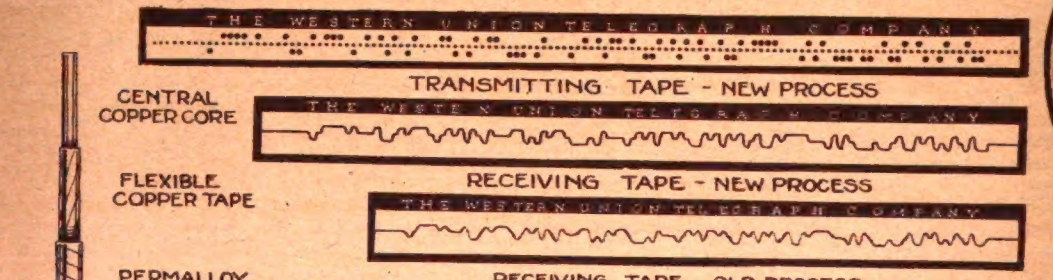
New U. S. to Italy Cable

The latest engineering feat of the Western Union Telegraph Company is the perfection of a new submarine cable which works at a speed approximating radio. The new cable connects New York with Italy and Spain via the Azores. The fact that secrecy and extremely high speed transmission can be combined in this cable gives it some advantage over radio. The cable is specially constructed as shown in the lower left hand corner of this page. The use of the permalloy tape permits the transmission of messages at a rate of fifteen hundred letters a minute. This tape increases the electrical inductance of the copper wire with a consequent increase in the capacity of the wire to carry messages.



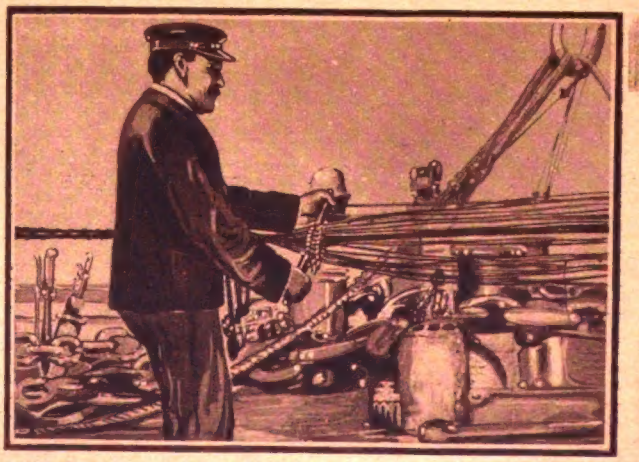


The illustration in the upper left corner shows the method of laying the deep sea cable. The cross-section diagram above shows how the cable follows the contour of the ocean bed.

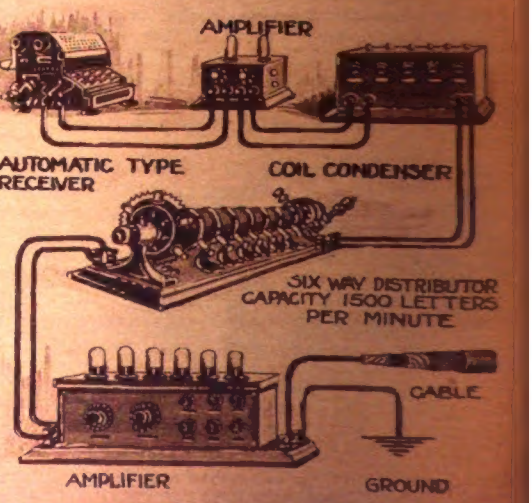

THE WESTERN UNION TELEGRAPH COMPANY
TRANSMITTING TAPE - NEW PROCESS
RECEIVING TAPE - NEW PROCESS
RECEIVING TAPE - OLD PROCESS

The sections of tape shown above enables speedy transmission which is readable. The old style tape shows its inefficiency.

The photograph directly above shows the buoys which automatically hold the end of the cable in case of a break.



Above: Splicing a section of the trans-Atlantic cable. The workman is putting on the steel armor layer.



Above: Transmitting and receiving apparatus, showing how six messages are cared for simultaneously.

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Meteoric Showers

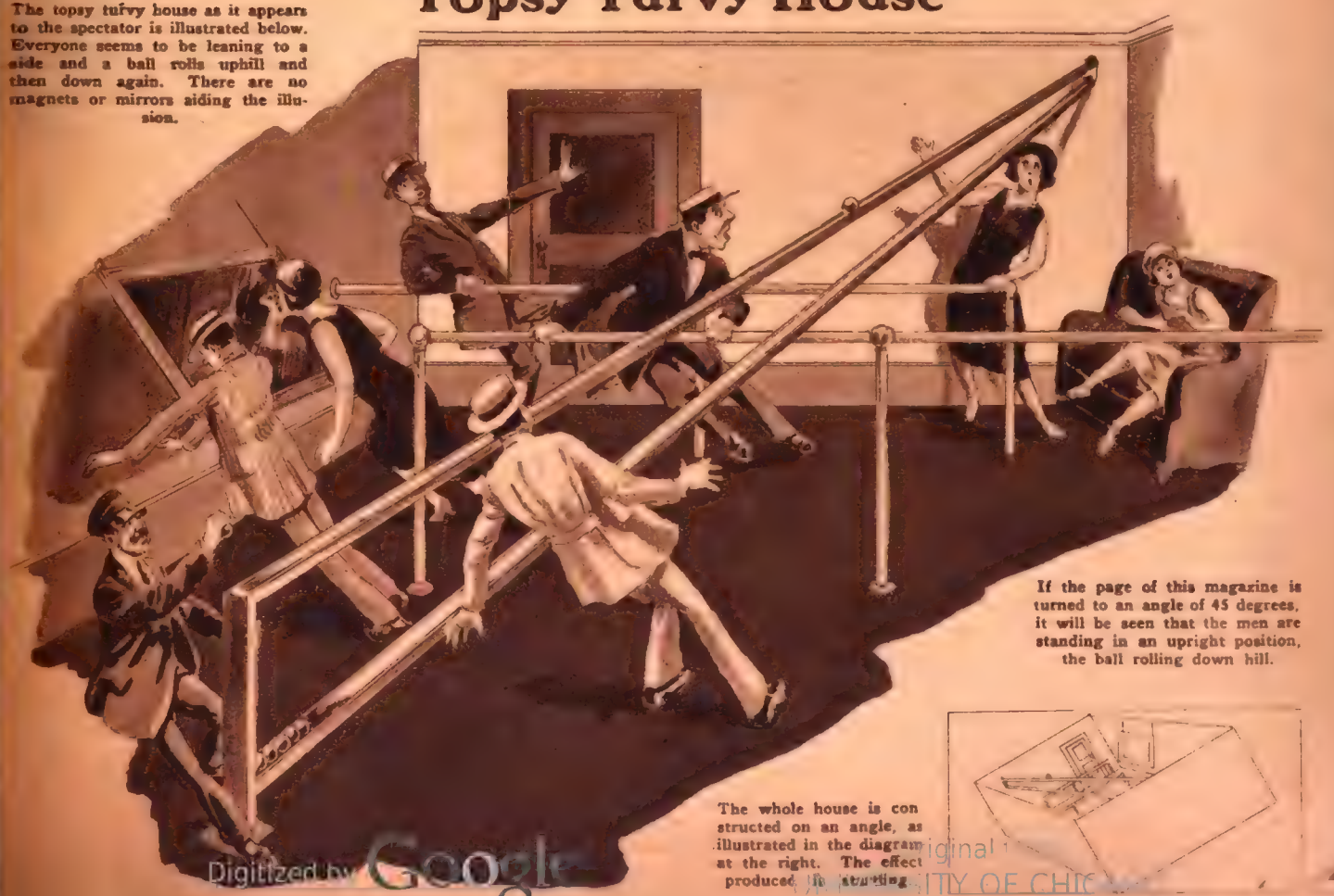
By DONALD H. MENZEL, Ph.D.

On July 6th at 4:20 P. M. a number of persons who were watching a ball game at Greeley, Colo., were startled by hearing four terrific explosions followed by a series of minor ones like the crackling of machine guns. Grayish blue smoke puffs appeared and then a number of meteors crashed to earth. The event is of great scientific importance, for it was one of the rare instances where the fall was actually witnessed. The first meteor weighing fifteen pounds hit the roadbed in front of a church, and other fragments were scattered far and wide over an area of ten miles. The largest weighed fifty-four pounds and the total weight of all the fragments recovered was eighty-two and a half pounds. In appearance they resemble brownish granite, known geologically as Chrysolite.

As the earth speeds along at the rate of twenty miles a second, it often rushes into particles of rock and metal flying free in space. The friction of their passing through the earth's atmosphere and their impact heats them to incandescence making the smaller particles appear as "shooting stars." Such large rocks as illustrated in the photo are almost unknown.

Topsy Turvy House

The topsy turvy house as it appears to the spectator is illustrated below. Everyone seems to be leaning to a side and a ball rolls uphill and then down again. There are no magnets or mirrors aiding the illusion.



If the page of this magazine is turned to an angle of 45 degrees, it will be seen that the men are standing in an upright position, the ball rolling down hill.

The whole house is constructed on an angle, as illustrated in the diagram at the right. The effect produced is startling

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The Future

SOME of the wonders which we may expect from science are pictured on this page. Most of them are the ideas of J. B. S. Haldane, of the University of Cambridge. One of the first advances which we may expect is the perfection of cold light. When that time comes, we may expect cities to be light continuously for illumination will be produced very cheaply.

Radio vision is almost with us now. The work along this line is fairly well known to readers of SCIENCE AND INVENTION. However, the future will find it developed to perfection.

There is much talk at the present concerning the effect of radio on weather conditions. Our descendants will no doubt control perfectly the atmospheric conditions with the aid of a few simple radio sets delivering power into the air.

And as for power, in the future it will all be developed through the agency of an atomic motor. A very small amount of space will be required for the greatest of powers—and it will be under perfect control.

Our sons will see wonderful aerial developments.

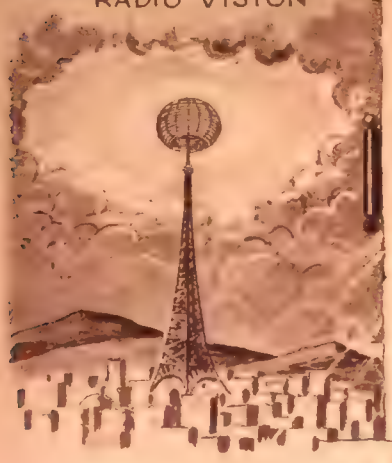
Another source of power will be huge windmills condensing hydrogen to a liquid form and storing it in vats.

Our food will be a chemical substance in the form of pellets. German professors have already ascertained that acid sodium phosphate increases the endurance of man's muscular power some seventeen per cent.

Glass will find greater and greater use in architecture, and buildings will become constantly larger. Interplanetary communication will be a constant accomplishment performed possibly with the aid of huge lighted areas of the oceans or large deserts.

COLD LIGHT 95% EFFICIENT

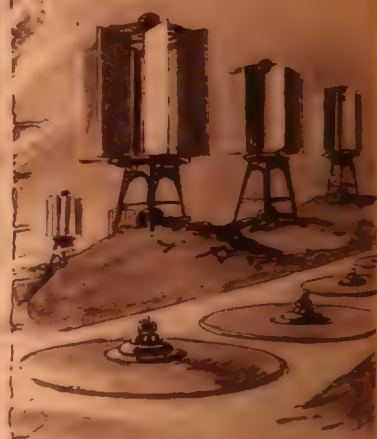
RADIO VISION



RADIO POWER STATION DISPERSING RAIN CLOUDS

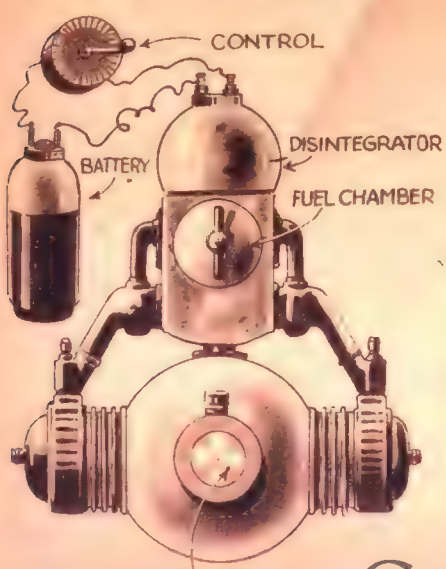
1,000 MILES PER HOUR

AERIAL FREIGHTER



WINDMILLS AND LIQUID HYDROGEN STORAGE VATS

ACID SODIUM PHOSPHATE AS A BEVERAGE
FOODSTUFFS MADE OF COAL AND ATMOSPHERIC NITROGEN



INTERPLANETARY COMMUNICATION BY ILLUMINATED OCEAN HIGHWAYS

THE USE OF GLASS IN ARCHITECTURE

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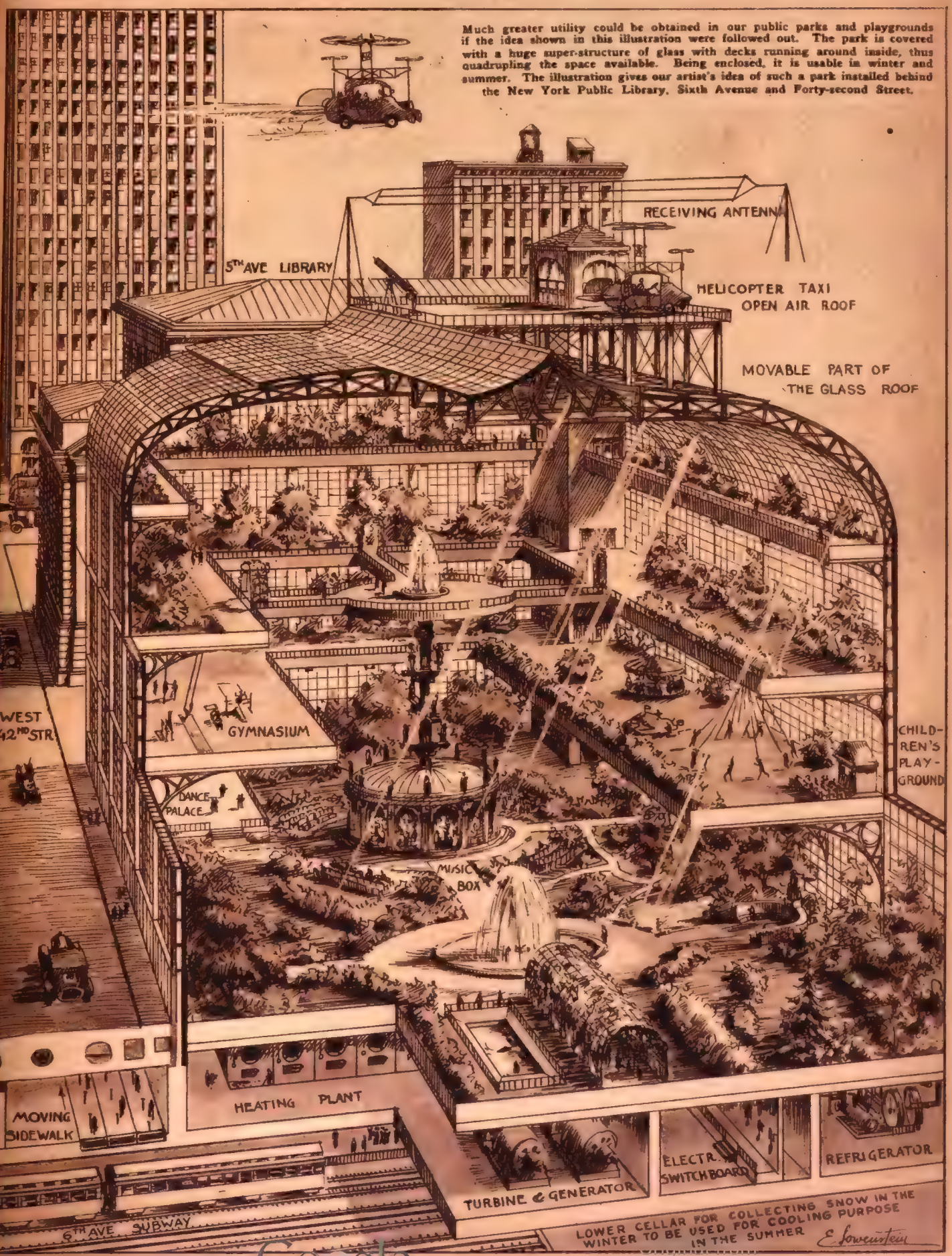
Skyscraper Park

Much greater utility could be obtained in our public parks and playgrounds if the idea shown in this illustration were followed out. The park is covered with a huge super-structure of glass with decks running around inside, thus quadrupling the space available. Being enclosed, it is usable in winter and summer. The illustration gives our artist's idea of such a park installed behind the New York Public Library, Sixth Avenue and Forty-second Street.



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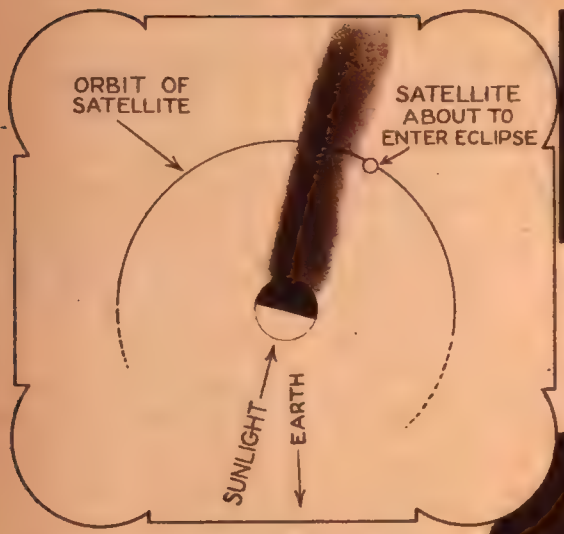
Moons of Jupiter

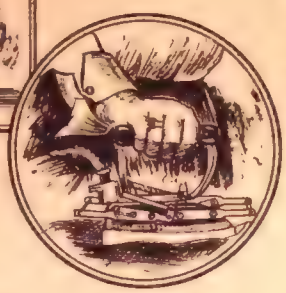


In the course of the revolution of the satellites of Jupiter around their planet, they occasionally enter its shadow and suffer eclipse. The photograph below was taken as one of the moons of Jupiter was about to enter eclipse. Successive pictures were taken of the planet, indicated by the big dark smudges below. Reading from right to left one will see that at first all four satellites are visible, and then the center one of the three moons disappears as it enters eclipse. Notice the gradual fading before it becomes completely invisible.

The picture above illustrates the comparative sizes of Jupiter's satellites, and the Earth, Moon, Mercury and Mars. Jupiter itself is about eleven times the diameter of the earth. Its moons are airless bodies and probably could not support life. It is interesting to learn that the satellites are about as large as the smaller planets, two of them in fact surpassing Mercury in size.

Four of Jupiter's nine satellites are large enough to be seen in a field glass.
—Charles T. Howard, Ph.D.

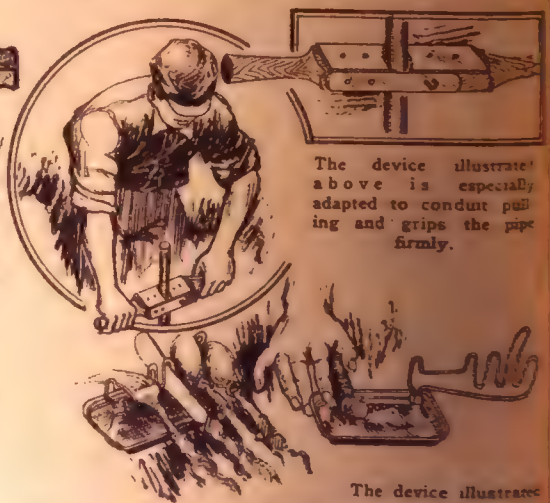
New Inventions Not On the Market



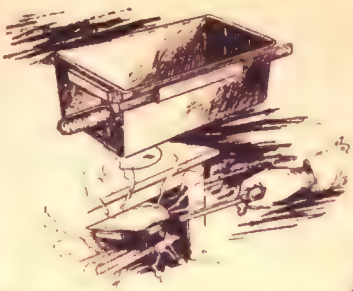
An electric iron resting on its own supports is shown above.

As the handle of the electric iron is grasped, the supporting legs automatically collapse out of the way, and the iron is ready for use. The alarm watch shown below gently taps the wrist of the wearer, thus awakening him or notifying him of an appointment which must be kept. The remarkable feature is that it disturbs no one but the wearer.

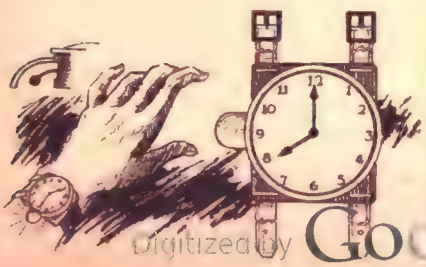
A partition in the center of the salt shaker and holes in the shoulder of the device produce a salt or pepper shaker and provides advertising space on the top.

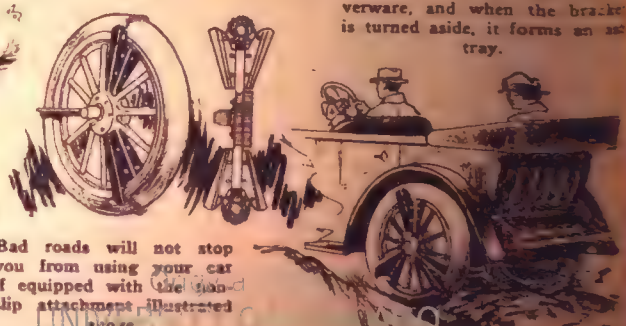


The device illustrated above is especially adapted to conduit pulling and grips the pipe firmly.



The handy-grip baking pan illustrated above has a special slot provided in its sides into which detachable handles are pushed so that the pan may be removed from the hot oven with ease.





Bad roads will not stop you from using your car if equipped with the non-slip attachment illustrated above.

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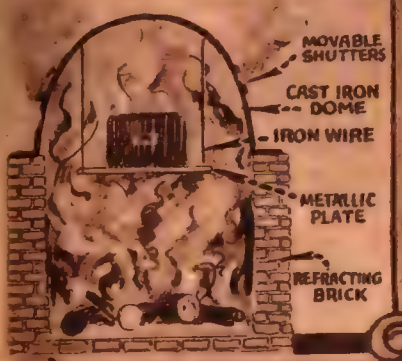
Cremation—A Modern Science

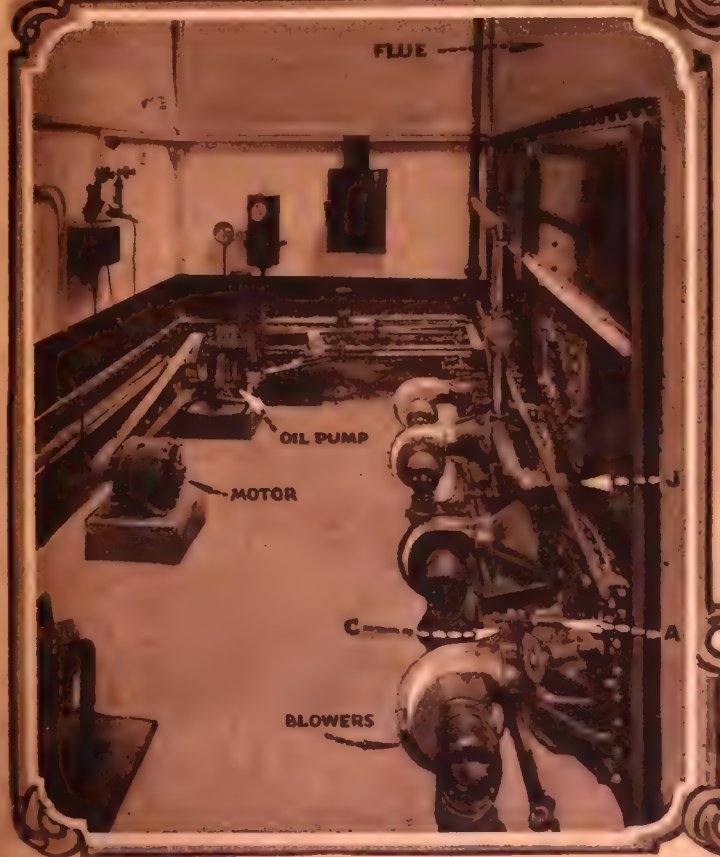
By SHEBA HARGREAVES

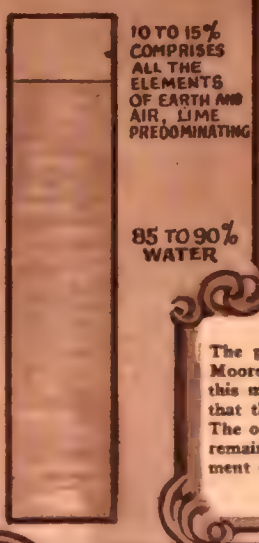
Even the earliest recorded history indicates that primitive peoples had crude ideas of sanitation, and they practiced cremation during pestilences and after battles. But cremation was just the lesser of two evils. The ancient funeral pyre was not only extremely unsanitary, but was abhorrent to the senses. There are vague ideas current as to the method by which cremation is effected today, and much of the prejudices against incineration arises because of this mistaken assertion that cremation still clings to its ancient form. Nothing could be further from the truth. It is a science.

The above photo shows casket chamber in modern Moore retort. This measures three feet by two feet eight inches, by nine feet. The walls and roof are of fire brick, and the floor of especially prepared fire tile. The combustion chamber underneath is equipped with two oil burners, and the hot gases enter through an aperture in the side walls, travel past the casket and thence up the smoke stacks. The diagram below explains the action. A grooved channel in the sloping floor separate coffin metal from the ashes.



The cremation movement proper was ushered in during the latter part of the nineteenth century. The modern type of crematoria was devised by Prof. Brunetti of the University of Padua, who exhibited a model of his apparatus in Vienna in 1873. Cremation societies sprang up at once both in America and in Europe. This type of apparatus is illustrated at the left. The crematory was used in the open air, and is known as the direct fire type. Incineration was complete in four hours.





The photo above shows the ornate chapel in the Moore crematory. Cremation is accomplished in this modern retort in one hour. It cannot be said that the human organism is burned in any retort. The organism is 85 to 90 per cent. water, and the remaining 10 to 15 per cent. comprises the element of earth and air with calcium predominating.

The process of dissolution is always by combustion of gases, whether this be brought about in a short hour by heat, or slowly by the processes of decay underground, or worse yet by the arrested decomposition occurring in the mausoleum crypt. The photo at the left shows the works of a modern crematory. The apparatus is so noiseless in operation that the phones in the back may be used at any time. C indicates the oil controlling valve, and A the oil pipe, while J is the main oil supply line.

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The Month's New Devices

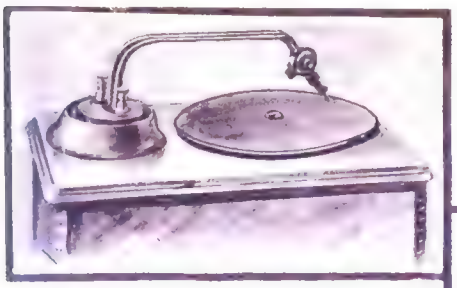
For waxing floors the housewife will find the above illustrated mechanical surfacer extremely handy. At the right above is given a new double, frying pan which enables the housewife to cook two different foods at the same time.

At last a little attention has been given the dressing difficulties of the male. Note the chair above. The back forms a coat hanger, a collar drawer slides out from beneath the seat, and a foot rest is incorporated.

The vest pocket microscope illustrated above will at once find its way to the heart of the traveling scientist or physician. It has sufficient magnifying power for all ordinary field work. It has already been adopted by a number of college professors.

The automobile radiator shown in the illustration at the right promises to increase the efficiency of trucking. Instead of taking a truck out of service on account of a broken or smashed radiator, it will only be necessary to haul out the old monkey wrench and install a new section for the broken one, which is a matter of a few moments only with this new device.

The addition of the small wire cups shown in the sketch below to baby's crib, will keep him from throwing the covers off during the night. —Mrs. C. M. Worthley.

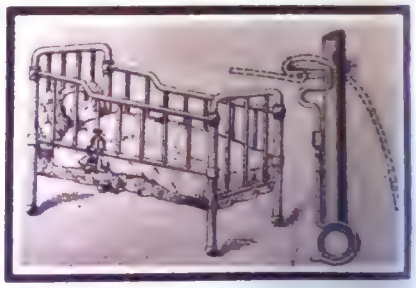


For reproduction of phonograph records, either for attachment to a radio transmitter or for increasing its volume, the little device pictured above manufactured by an English concern, will find a hearty reception among the amateur engineers. The device attaches directly to the phonograph, has its own reproducing arrangement and tone arm and binding posts for the attachment of the wires. It gives very clear and even reproduction

In purchasing silk hosiery over the counter, the lady shopper need no longer worry as to whether she is getting perfect quality. The stocking is placed on the stand shown above, which has a light within.

The can opener illustrated above cuts the top as close to the rim as possible, allowing the contents to fall out in one chunk without being broken. It is extremely simple, consisting of a steel wheel fixed to a wire handle.

The latest in vacuum cleaners appears in the sketch to the left. The system involved is practically the same as that employed in the larger machines. It is much easier to carry



OR MANUFACTURERS' NAMES AND ADDRESSES ENCLOSE STAMPED SELF ADDRESSED ENVELOPE WITH QUERY.

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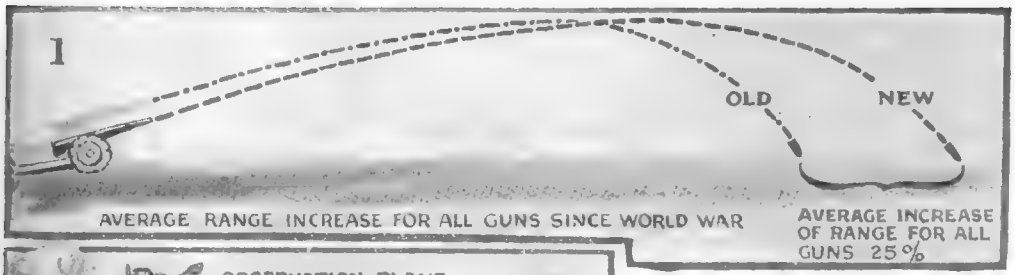
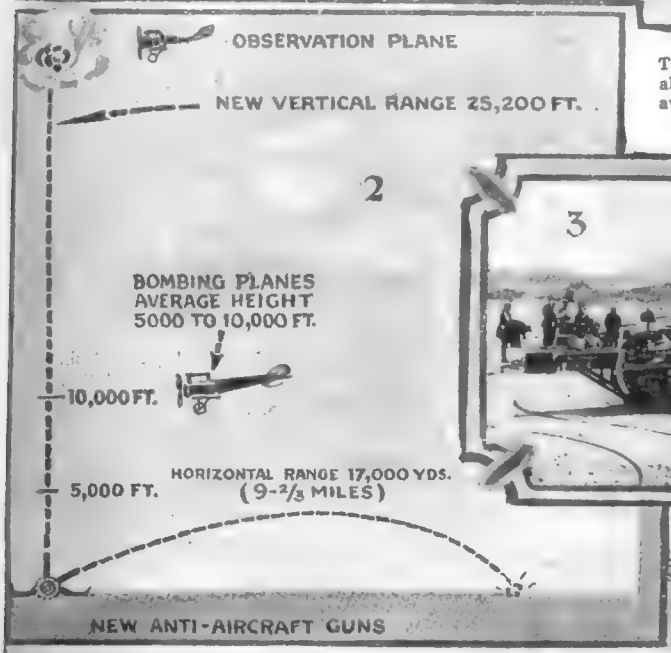
The Next War's Ordnance

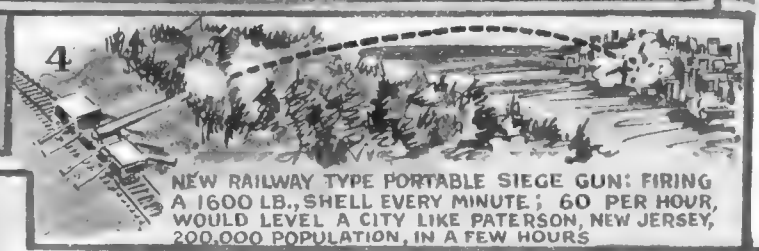
By H. WINFIELD SECOR

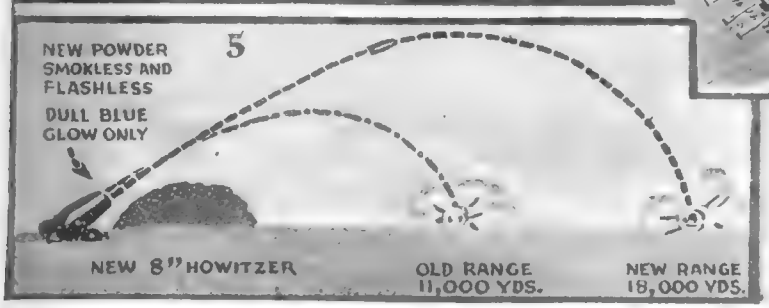


The over-all range of the artillery of all countries has increased by an average of 25 per cent. since the World War.

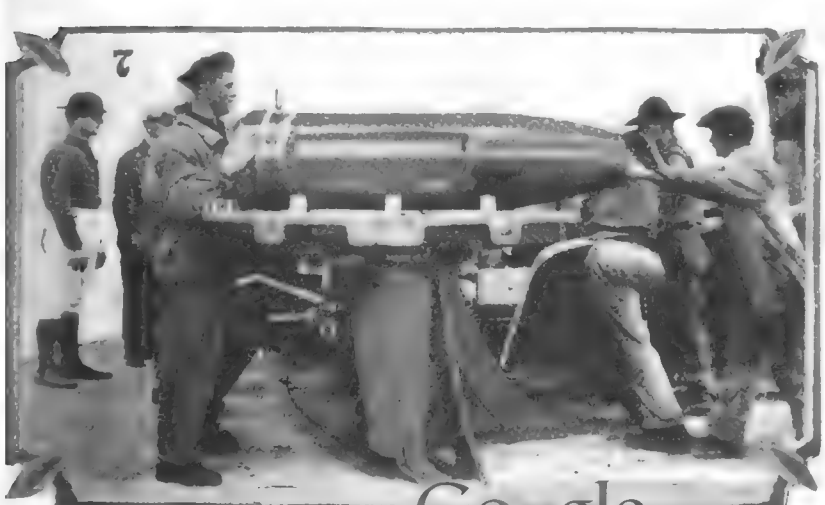
In a recent speech made before the Franklin Institute, Major General C. O. Williams, U. S. A., described some of the developments which have been made and will be made in the world's fighting equipment. Immediately below is shown the new coast defense gun recently adopted by Army officials, which fires a sixteen hundred pound shell and has a range of thirty-five miles. Installed at New York Harbor a few of these guns could easily give protection as shown in Fig. 8.

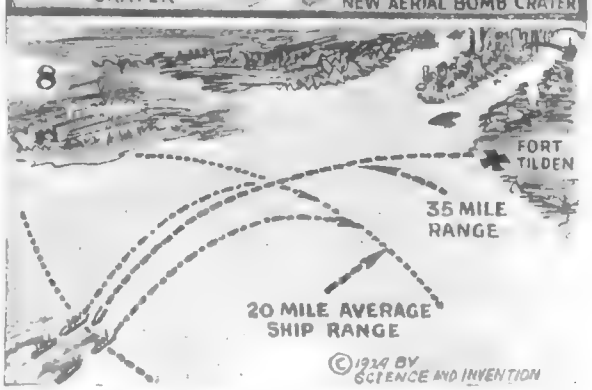



4
NEW RAILWAY TYPE PORTABLE SIEGE GUN: FIRING A 1600 LB., SHELL EVERY MINUTE; 60 PER HOUR, WOULD LEVEL A CITY LIKE PATERSON, NEW JERSEY, 200,000 POPULATION, IN A FEW HOURS



At 2 is graphically illustrated the newest anti-aircraft gun with a vertical range of 25,200 feet. This gives protection from bombing planes and to some extent from observers. When the bomber rises above 10,000 feet, his work ceases to be effective. At the horizontal setting, this gun has a range of almost ten miles. At 5, is shown the latest development in howitzers for use in close demolition. It fires an 8 inch projectile and uses a new powder, which is both smokeless and flashless. It burns with a dull blue glow.





Aerial bombing has thoroughly established itself for siege tactics. The latest developments along this line are given in illustration 6. An aerial bomb six times more destructive than any used during the World War, is one of the greatest advances along this line. At the left in Fig. 7 is shown a photograph of shell for new gun pictured in the photograph at 3. At 8 the map shows clearly how the long range guns would give ample protection against an enemy fleet for New York City.

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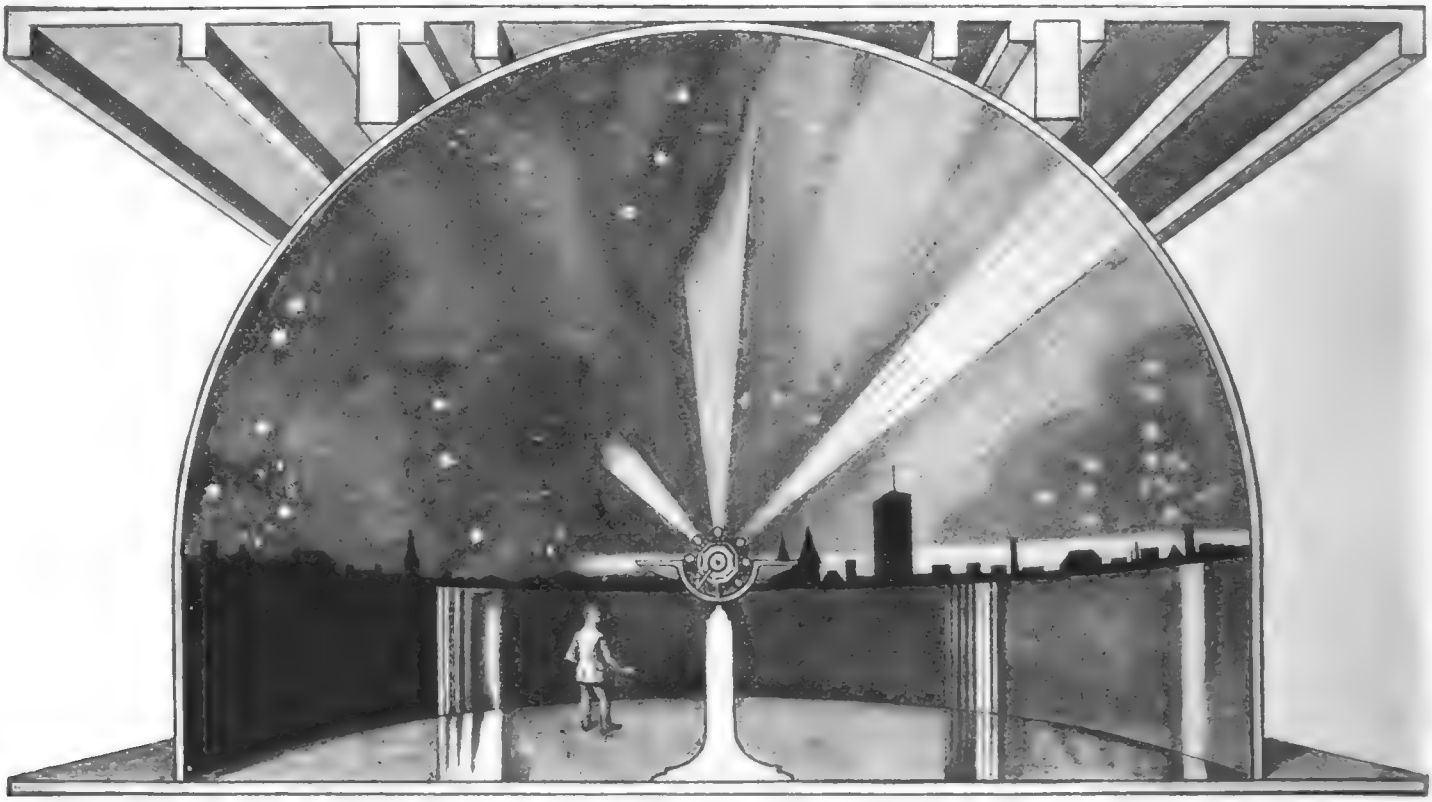
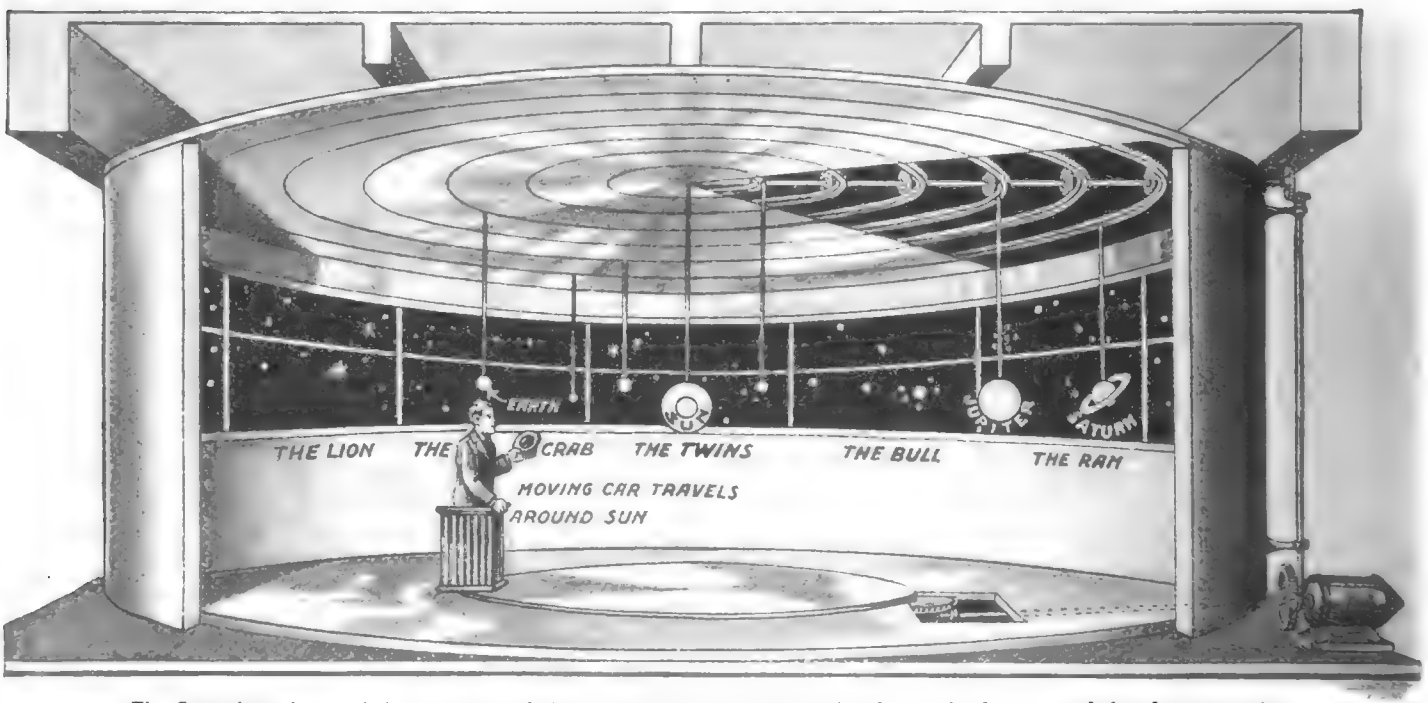
Old Ptolemy's Planetary Idea



With the spires and towers of Munich's skyline as a background all the planets, the constellations, the sun and the moon travel through the huge blue dome representing the heavens in the great Ptolemaic planetarium at the Munich Museum.



The Copernican theory of the movement of the heavenly bodies is shown with the sun in the center of the planetary system through another planetarium of the Museum. As a result of its size and careful engineering its movements are almost perfect.

THE worthy ancients who studied at the feet of Ptolemy, had an explanation of the movement of the heavenly bodies that was interesting if not correct. They considered the earth the center of the universe around which all the bodies traveled. In order to show clearly their conception, the Munich Museum has erected a huge planetarium working according to their theory. From projectors on a pedestal, beams of light representing the moon, planets and constellations travel around a 27-foot hemisphere which represents the heavens. The projectors are all connected mechanically and a small electric motor revolves them through timing gears. Nearby, there is a more elaborate planetarium of the Copernican system—the correct system as conceived today—with the planets revolving around the sun and the constellations painted on the wall. Also, the satellites of each planet are shown. A system of gears back of the ceiling above the thirty-foot housing of the apparatus drives the planets around the sun. Each planet is equipped with a cycle regulator, electrically operated, which corrects its motion every five seconds so it is impossible for discrepancies to appear. In the Ptolemaic planetarium the heavens perform a day's circuit in four minutes. In the Copernican apparatus the earth completes a year's revolution around the sun in ten minutes. Also students may hasten the movements of the astronomical bodies. The observer can rotate in a box with and just under the earth.

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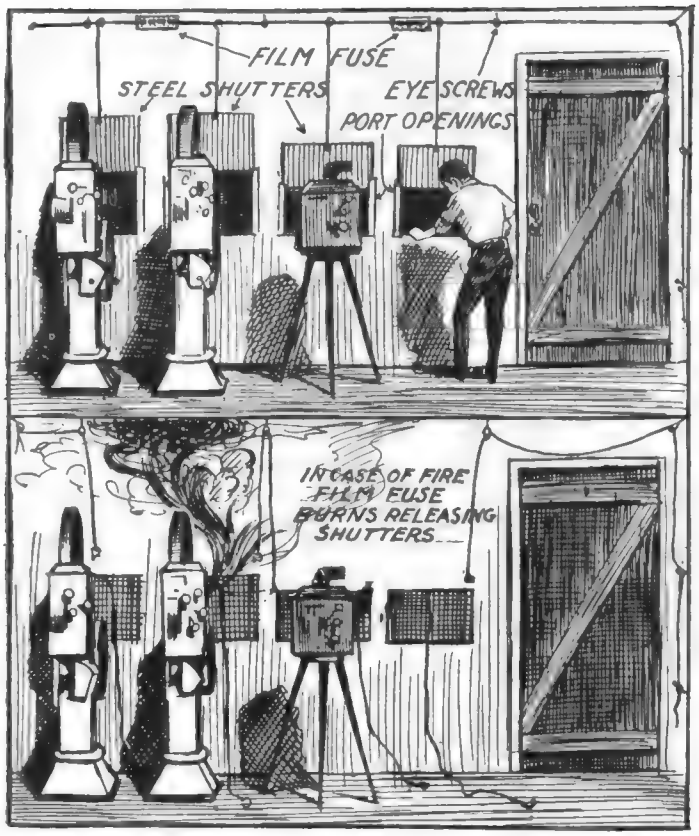
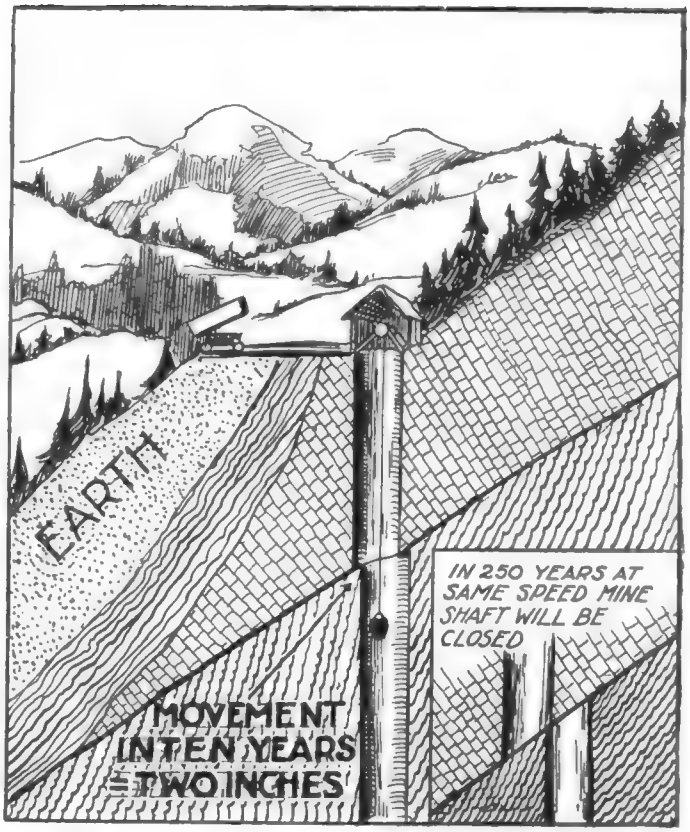
Fire Prevention



By housing the moving picture projectors and the spotlights of a theatre in a metal booth which is insulated from the building walls and fitting it with metal shutters which are closed when the booth is heated to a point where celluloid film takes fire practically all danger of fires starting from film are eliminated.
—B. A. Cawthon, Rep. 1864.

Earth Fault

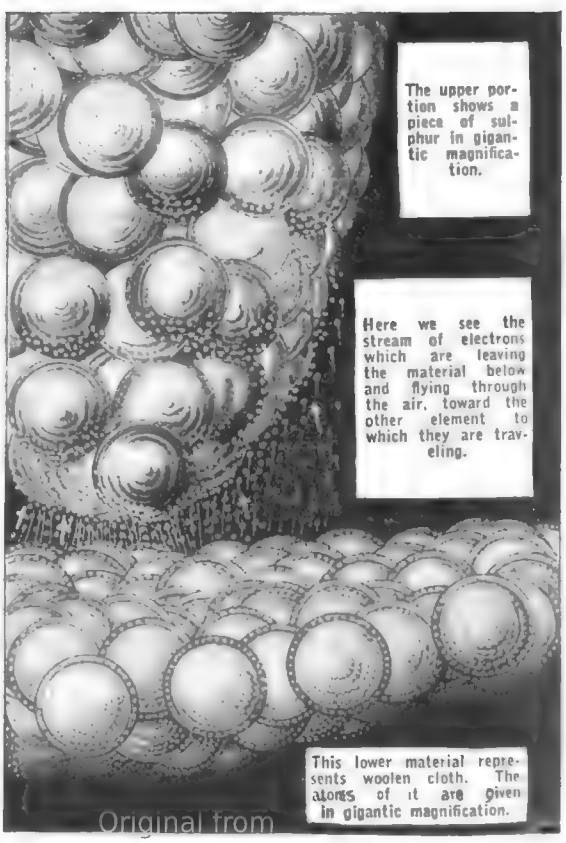


In driving down a mine shaft in the West some years ago it was necessary to pass through the top layer of rock into a stratum running the opposite way. That the top of the mountain is actually sliding down may be seen in the section view above, which shows the displacement in the shaft in ten years' time.
—F. Rattak.

The Human Nose

The drawing on the left shows the apparatus of smell in the human body. The carnation gives forth an odorous substance which is easily diffusible in gaseous form. This dissolves in a fluid secreted by certain cells in the olfactory epithelium in the upper part of the nasal cavity. The nerves are stimulated by this solution and their stimulation causes a transmission of the impulse to the brain. A stimulation of different nerve endings produces a different sense of smell. Thus a pungent smell involves the stimulation of nerves of common sensibility, as for instance, the fifth nerve and also a stimulation of the olfactory nerve.

Electron Action


The upper portion shows a piece of sulphur in gigantic magnification.
Here we see the stream of electrons which are leaving the material below and flying through the air, toward the other element to which they are traveling.
This lower material represents woolen cloth. The atoms of it are given in gigantic magnification.

An attempt to show in picture form the action of electricity and the travels of electrons. By rubbing a piece of sulphur with wool, the electrons are started into motion.

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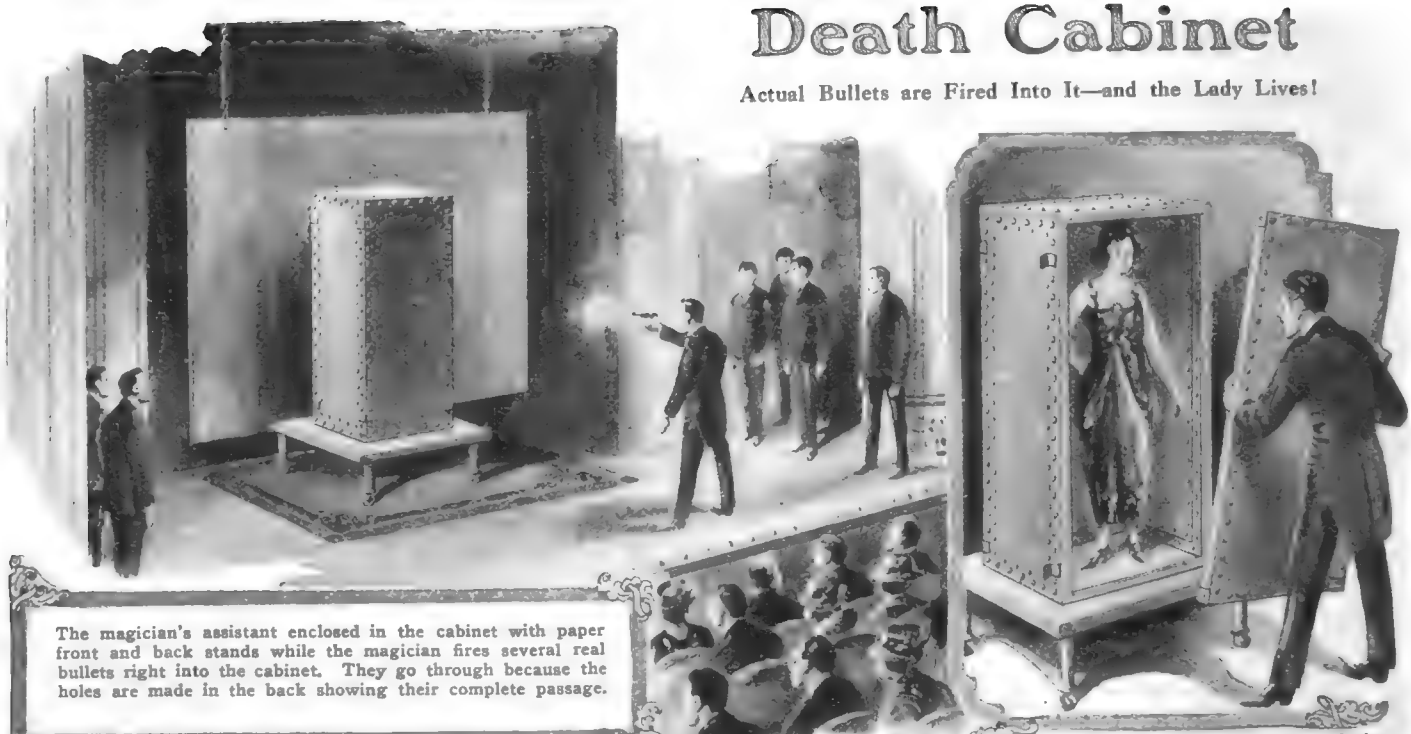
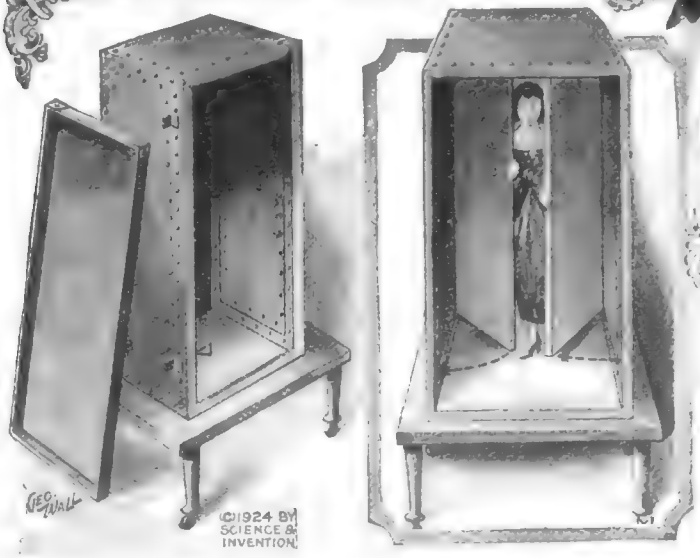
Death Cabinet

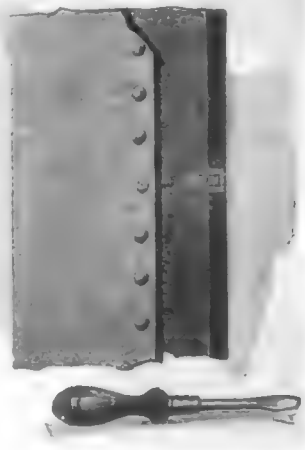
Actual Bullets are Fired Into It—and the Lady Lives!



The magician's assistant enclosed in the cabinet with paper front and back stands while the magician fires several real bullets right into the cabinet. They go through because the holes are made in the back showing their complete passage.

Above the magician is shown placing the paper cover supported by a steel frame on the front of the cabinet. Below is shown the false screw which the assistant turns to release the steel doors which protect her from the bullets.

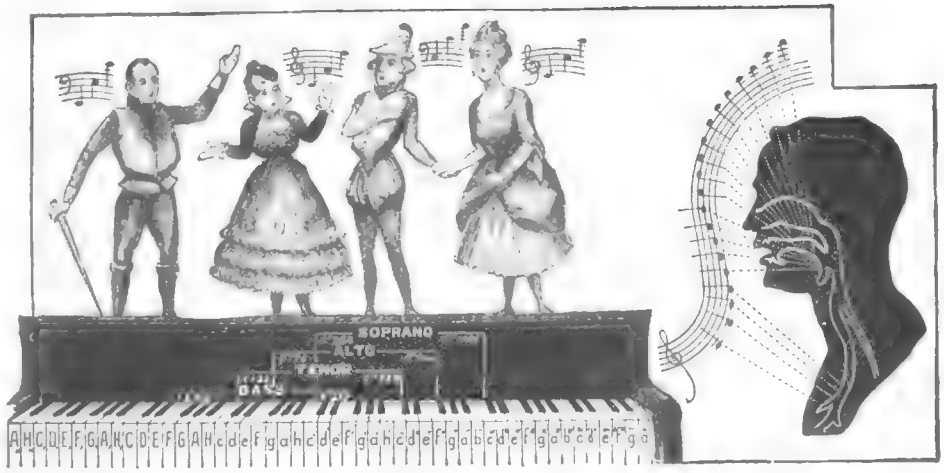




At the left is shown the construction of the safety doors which stop the bullets. When the assistant emerges, she pushes the doors in place, and picks up and conceals the bullets from the audience. She carefully counts the number of shots and throws an equal number of bullets already fired through the holes punched with her finger in the paper back.

—Prof. Joseph Dunninger.

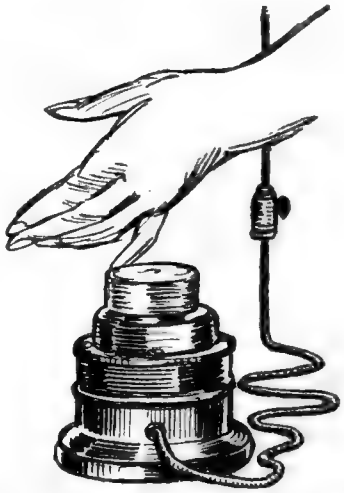
Where Singing Starts



When the opera singer trills a beautiful aria, the silver notes which float out and fill the auditorium so beautifully, come from a number of different locations. The small sketch at the right show the position at which the resonance of the respective notes originated. The piano keyboard marks off the various scales of ranges covered by the different parts. Nature determines what part a singer shall take.

—Kosmos.

Nail Buffer



The small device shown above of French origin promises to be one of the greatest helps to milady in keeping her nails beautiful. The small motor in the base turns the buffing wheel.

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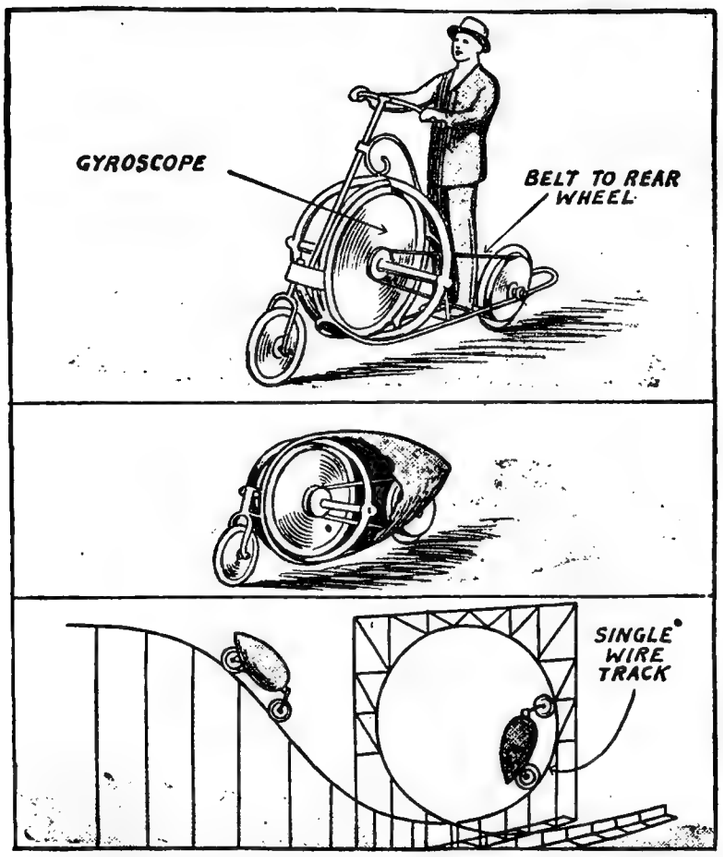
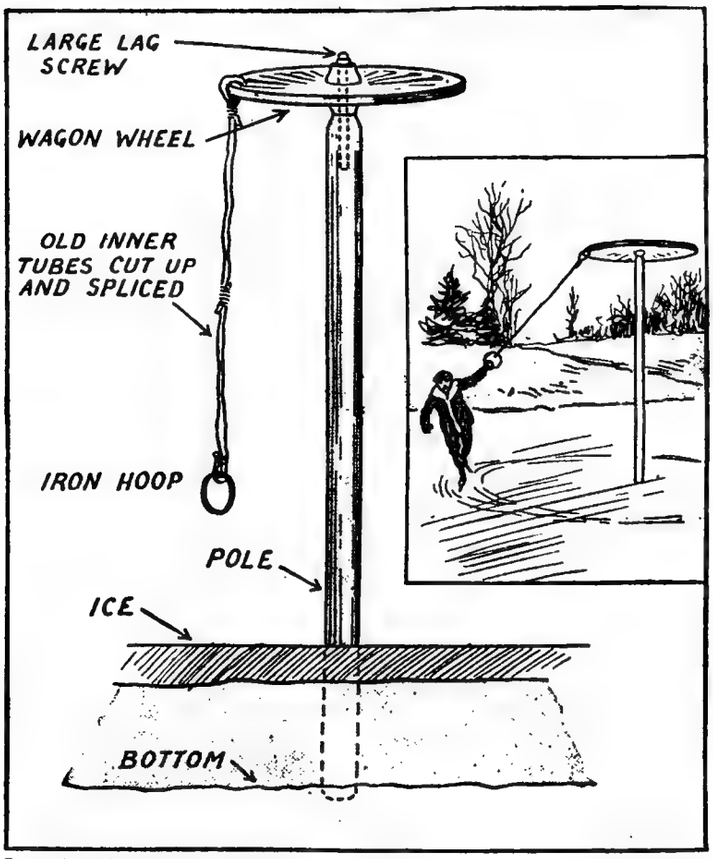
GYROSCOPIC TOY



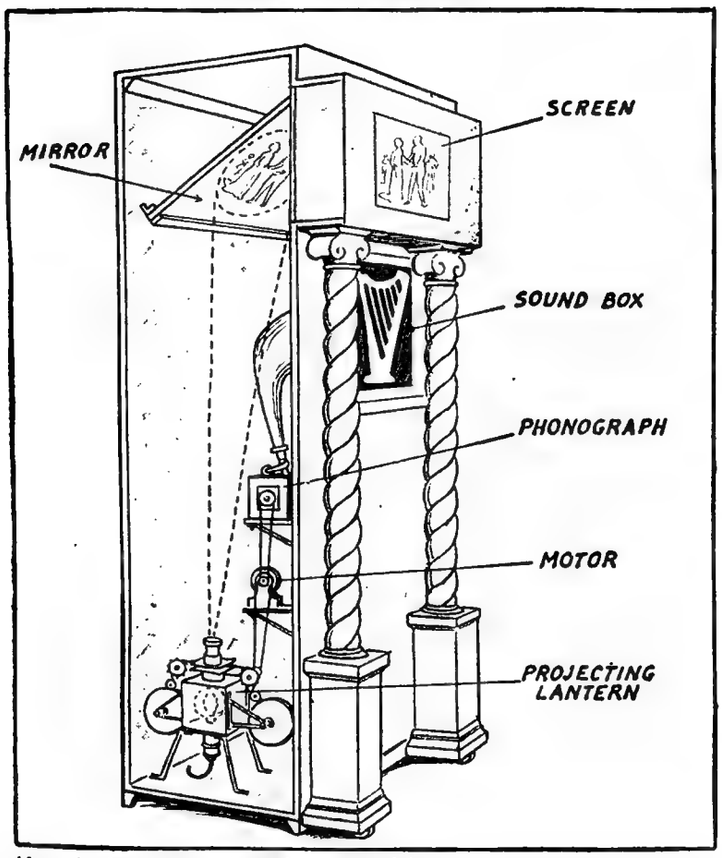
The toy shown above runs in a perfectly straight line and stands by itself in spite of the fact that it has only two wheels. The secret of its equilibrium as well as its motive power is the small gyroscope incorporated in it. Its inventor is H. Hebrard.

SKATING ACCESSORY



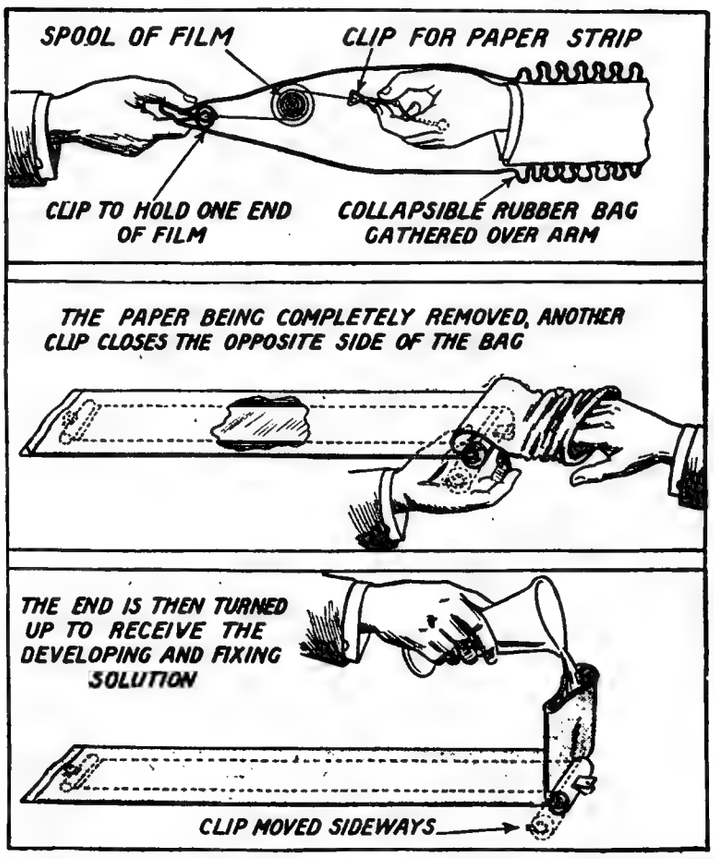
Cut a hole in the ice, insert and prop a pole and let the pond freeze solid. Now mount a large wagon wheel on top of it and with the aid of a lag screw a swinging contraption that will net much fun can be made. It is illustrated above. —Dale R. Van Horn.

HOME "TALKING MOVIES"



Above is shown a new invention for a talking motion picture cabinet for the home. The small projection machine is housed in the bottom of the cabinet. The picture is thrown on the screen above by means of a mirror which projects it onto the translucent screen. A phonograph, run in synchronism with the projector, is included. The inventor is a genius named S. Kucharski of Germany.

QUICK FILM DEVELOPMENT


SPOOL OF FILM
CLIP FOR PAPER STRIP
CLIP TO HOLD ONE END OF FILM
COLLAPSIBLE RUBBER BAG GATHERED OVER ARM
THE PAPER BEING COMPLETELY REMOVED, ANOTHER CLIP CLOSES THE OPPOSITE SIDE OF THE BAG
THE END IS THEN TURNED UP TO RECEIVE THE DEVELOPING AND FIXING SOLUTION
CLIP MOVED SIDEWAYS

This invention which consists of a closed rubber tube and a couple of clips allows photographic films to be developed in broad daylight. The tube is rolled over the arm and the film unwound within it, as shown in the above sketch. One end of the film is clipped and the film unrolled. The developing fluid is poured into the tube as shown by slipping one of the clips to the side. A patent on the idea was granted to E. J. Sweetland.

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Is Your Kitchen Efficient?

SINCE architects build most of our houses, the kitchens, a great many times, are extremely inefficient for cooking. A few hints for easing the work of the cook are given in this article. The two floor plans at the bottom will help greatly in explaining some of the points necessary in efficient construction. At the right is shown the proper placement of tables around the sink. Below at the left we have a very well arranged kitchen with a breakfast nook combined. All tables and sinks should be approximately thirty-four inches from the floor for best working conditions.—Mrs. Christine Frederick.

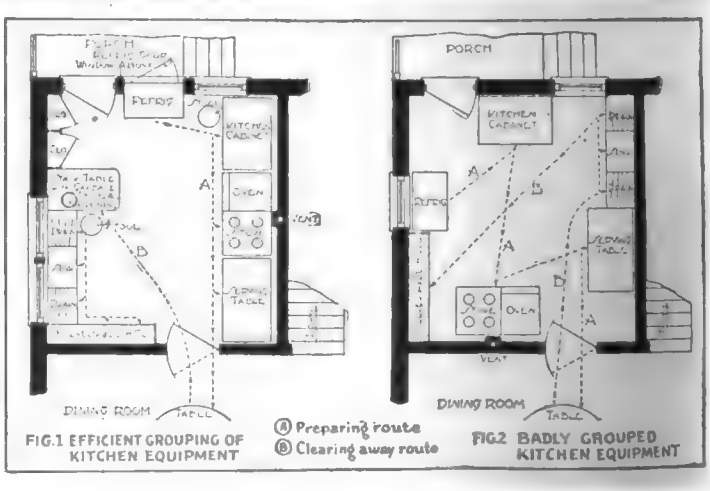

FIG.1 EFFICIENT GROUPING OF KITCHEN EQUIPMENT

Ⓐ Preparing route
Ⓑ Clearing away route

FIG.2 BADLY GROUPED KITCHEN EQUIPMENT

The Earth Lights the Moon

Astronomers have a habit of belittling the earth. However, here is a point which may tend to show that the earth is a fairly sizeable body after all. In the photograph at the left is shown a portion of the moon's surface photographed solely with the light reflected on to that satellite by the earth. The crescent at the left side is that part visible to the naked eye and which appears as the moon in the quarter. The small insert in the center and the sketch above explains this reflection of light, enabling this photograph to be taken. At the right above is shown the same portion of the moon photographed by the sun's light.—Photos Courtesy Harvard Observatory—Ronald H. Menzel, Ph.D.

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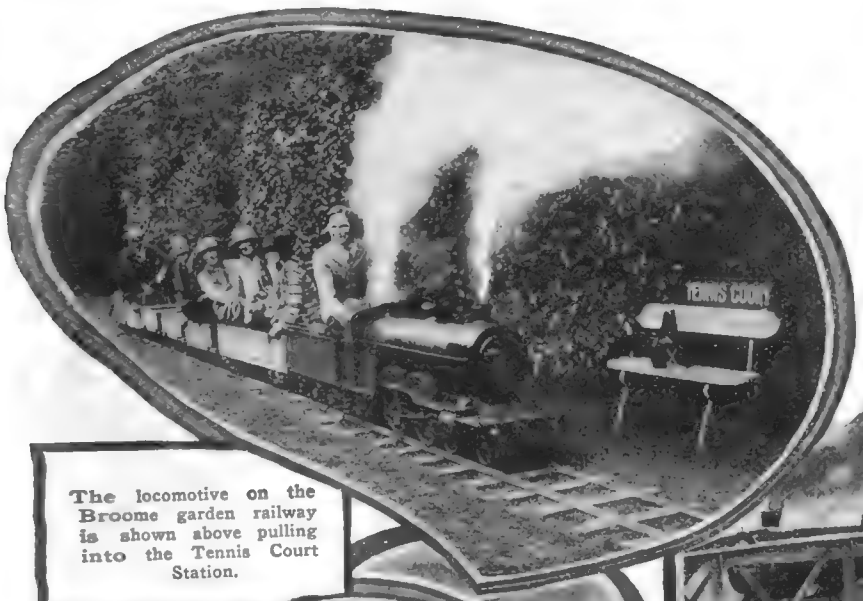
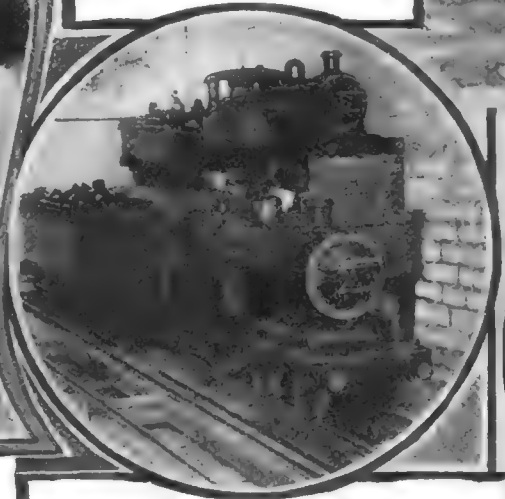
A Wonderful Miniature Railway



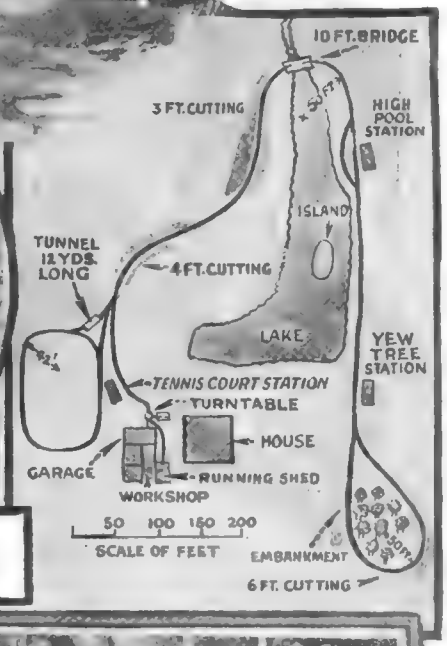
The locomotive on the Broome garden railway is shown above pulling into the Tennis Court Station.

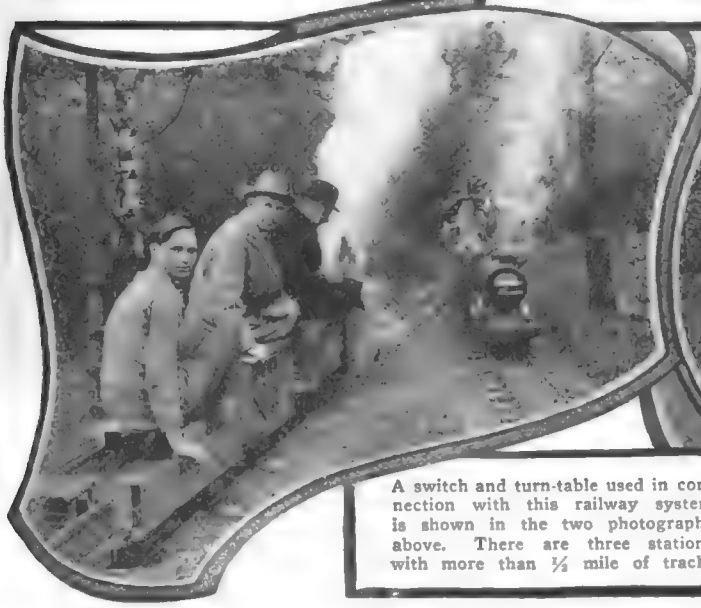
The ten foot bridge constructed in standard manner in this half mile private railway is shown in the above photograph.

The train is being pulled through the twelve yard tunnel in the railway on the estate of an English peer. The engine is fired with coal.

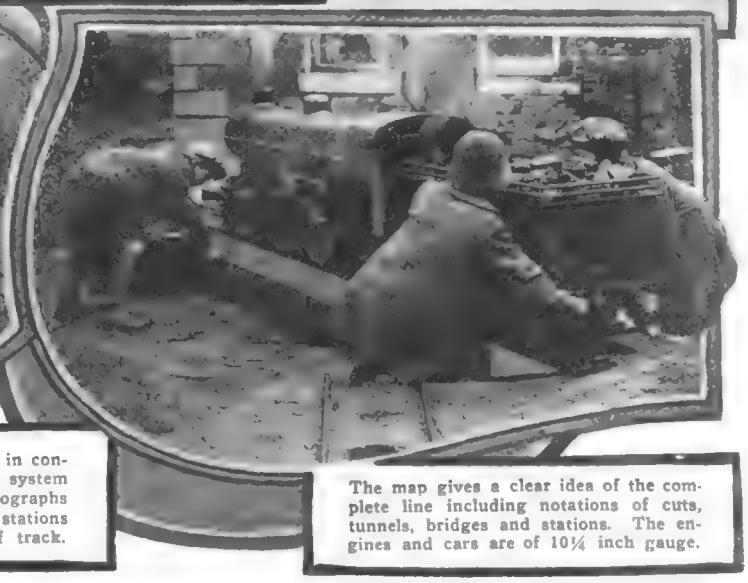


Two of the locomotives are shown in the shop above. They are replicas of standard engines.





A switch and turn-table used in connection with this railway system is shown in the two photographs above. There are three stations with more than ½ mile of track.



The map gives a clear idea of the complete line including notations of cuts, tunnels, bridges and stations. The engines and cars are of 10¼ inch gauge.

Photos Courtesy Model Engineer and Electrician.

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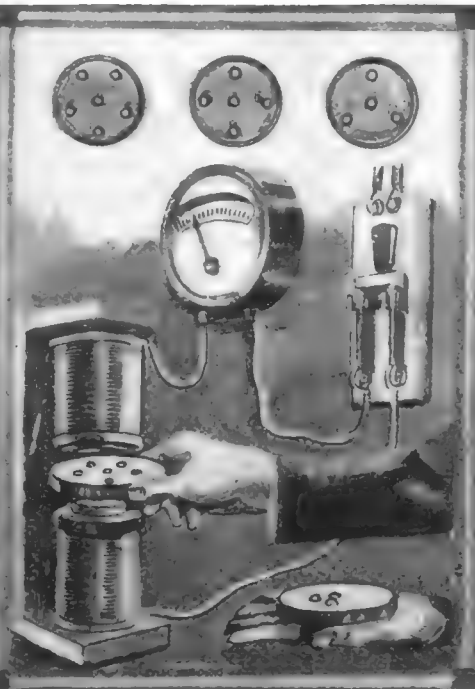
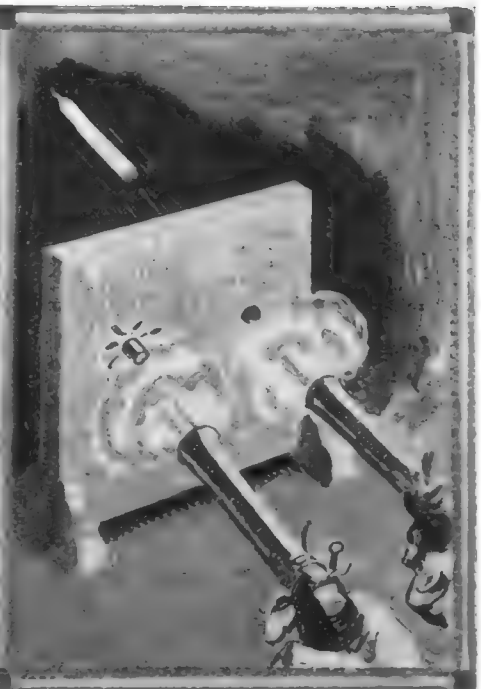
Scientific Problems and Puzzles

By ERNEST K. CHAPIN, M.A.

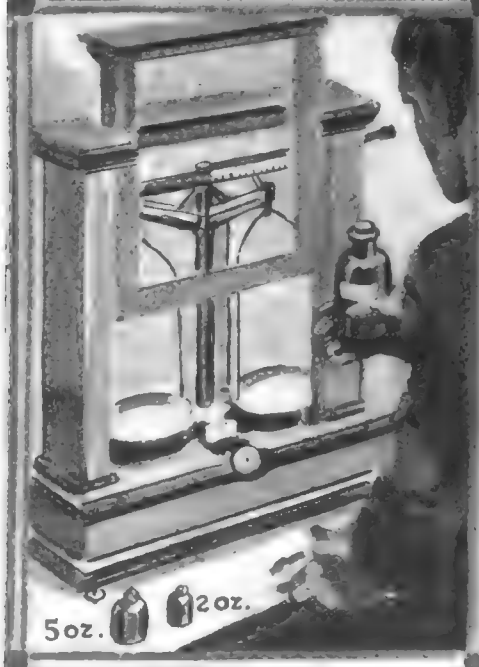
In a double track railway system running due north and south, there is always an indication of greater wear on the two outer rails, as indicated in the above diagram. Can you tell why this is so? And why is it that the wear is on the two outer rails, instead of on one inner rail and one outer rail?



Place a dish of mercury between the poles of a strong electro-magnet, and then float ball bearings upon the surface of the mercury. It will be found that the bearings arrange themselves in definite patterns according to the number floating on the surface. Why should the patterns be both definite and symmetrical?



Let us assume that we have two revolvers both containing an equivalent charge of powder, and we place into one of them a regular bullet made of lead. Into the other we place a bullet made from a tallow candle. It will be found that the tallow candle bullet penetrates a wood target more easily than the lead. Why?



A druggist had a very good beam balance and he was called upon on one occasion to weigh out one ounce of powder. He found that he accidentally misplaced all of his weights, with the exception of the two and the five ounce weight. With only these two weights, how did he manage to weigh out exactly one ounce of powder?

Eight boys of equal strength engaged in a tug of war. Four boys were on each end of the rope. Later they used the same rope to pull up a stump, one end of the rope being attached to the stump, and the other held by the eight boys. Under which of the two circumstances would the rope be most apt to break?

Suppose that we have two scales weighing a ten pound weight; both scales read correctly, and the weight of the scales themselves is one-quarter of a pound. Under the two circumstances illustrated in the diagram above, what would the reading of the scales be in either case, and how do you account for the readings?

Answers to problems given on page 814

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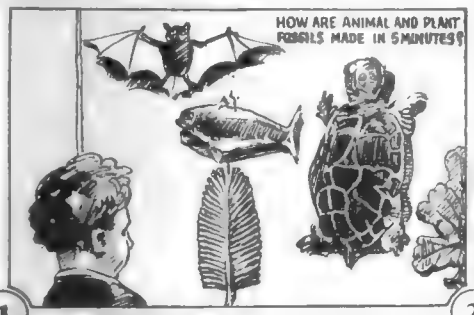
Everyday Chemistry

By RAYMOND B. WAILES

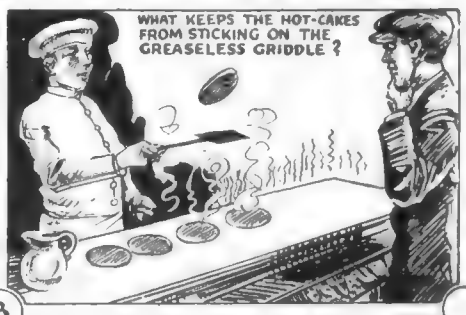


1

Experimental fossilization can be made with plant and animal tissues by immersing them in a solution of potassium permanganate which oxidizes the organic matter in a much shorter time than natural fossilization would.

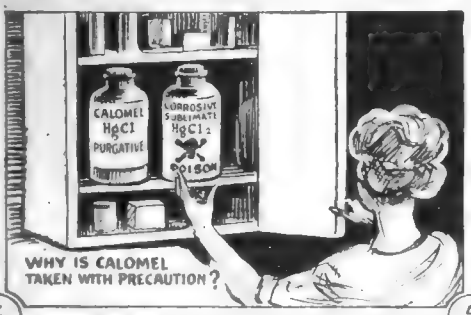
2

Most of the beauty clays on the market consist of Fuller's earth as a base and some tincture of benzoin. Fuller's earth is used to absorb grease marks from soiled surfaces, as wall paper, and in oil refining to eliminate impurities.



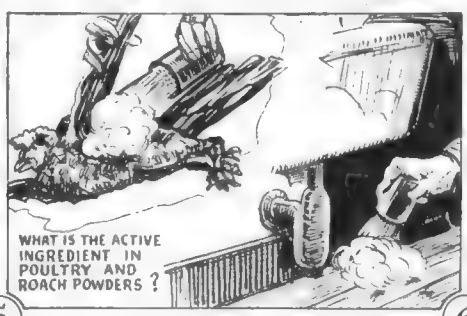
3

Griddles are usually made of an alloy of aluminum, which on being heated develops an oxide coating. This coating absorbs air which acts as an insulating layer between the hot cake and the body of the griddle.



4

Calomel is a combination of mercury with chlorine. Twice as much chlorine combined with the mercury produces corrosive sublimate. Precautions resolve upon probable conversion of the harmless into the poisonous compound.

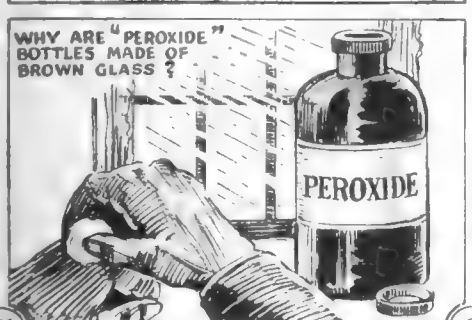


5

Sodium chloride is the active ingredient in poultry delousing powders and roach eliminators. It should be used straight for fowl and mixed with flour and sprinkled into the floor cracks for ridding premises of roaches.

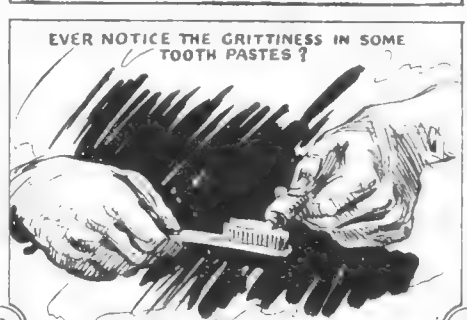
6

Fats are called glycerides by the chemist. When heated they form glycerine, which in turn is decomposed forming acrolein, an irritating and poisonous gas. Ask the cook if she makes acrolein and if she says "Yes," fire her.



7

Peroxide is very susceptible to decomposition. Light, heat and other agents cause its decomposition and ensuing weakness. Brown bottles effectively eliminate one cause of loss in strength, that due to light.



8

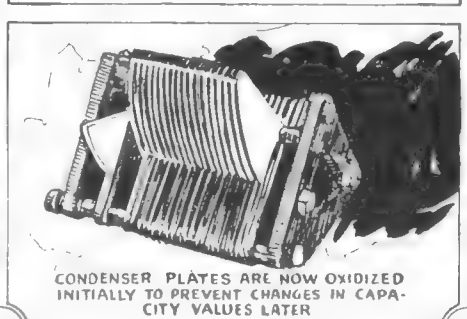
Don't be afraid of gritty tooth pastes. The grittiness is caused by calcium carbonate known also as marble, or calcium phosphate (eggshells or bone). The smoother creams employ saponin, a vegetable soap substitute.

9

Salt, generally used for electrical grounds, soon acts upon the copper plates buried in the ground, and brings about corrosion by the formation of copper sulphate. Substitution of copper sulphate solution for salt prevents corrosion.

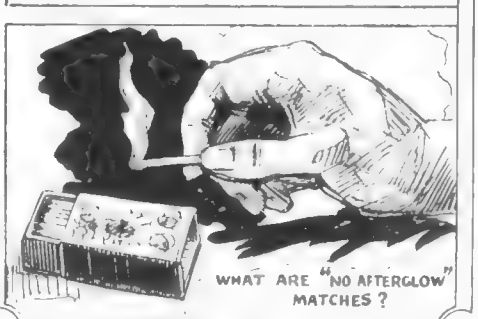
10

Coal contains sulphur which burns to form sulphur dioxide which in the cool moist atmospheres of tunnels forms sulphurous acid. This attacks the rail ties and causes them to rot faster than the ties in the open stretches.



11

Chemically treated aluminum condenser plates are immersed in warm ammonia water, which forms aluminum oxide on the plate. This is very resistant to ordinary natural forces, and the plates never vary in capacity values.



12

Safety matches are treated with copper solutions to make them non-after-glowing. The copper treatment causes them to quench their spark when the flame is extinguished. Such matches produce a greenish blue flame.

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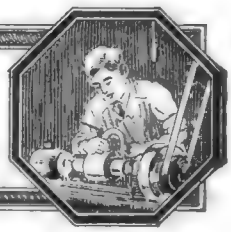
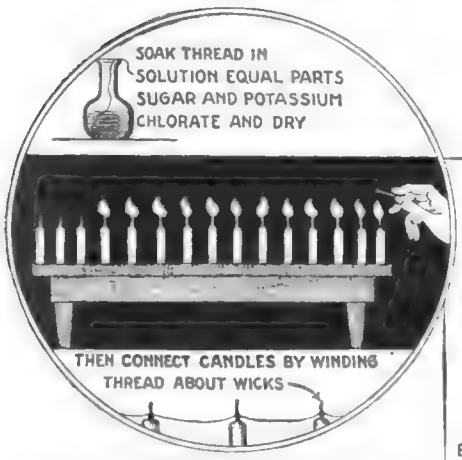
THE CONSTRUCTOR

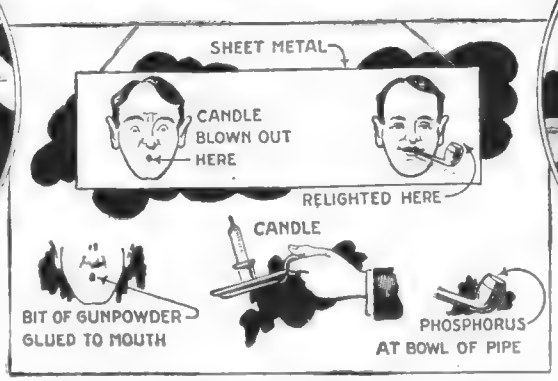


Mystification in Candle Tricks

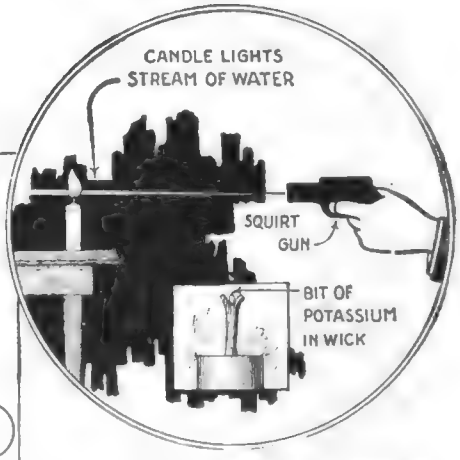
Chemistry Turns Magician for Entertainment


SOAK THREAD IN SOLUTION EQUAL PARTS SUGAR AND POTASSIUM CHLORATE AND DRY
THEN CONNECT CANDLES BY WINDING THREAD ABOUT WICKS

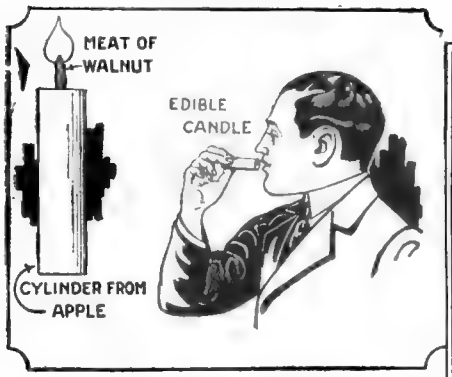
Connect several candle wicks with a piece of thread which has been soaked in a solution of potassium chlorate and sugar. Light one end of the thread and the flame jumps from candle to candle.



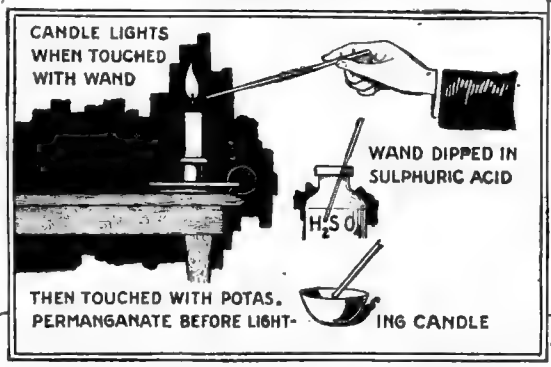
The faces on sheet metal perform this trick. The lighted candle is held to the gun powder, where the small explosion extinguishes it. The phosphorus in the pipe bowl relights the flame.



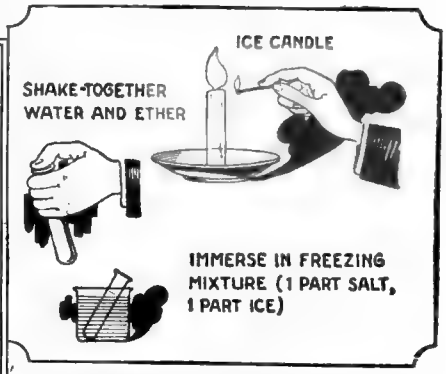
You may light a candle with a stream of water from a squirt gun if a bit of potassium is placed in the wick first. Be extremely careful in handling sodium or potassium. **ALWAYS** use tweezers.



An edible candle which will at once taste well and mystify onlookers, is made by constructing a cylinder from the fleshy part of an apple, and using the meat of a walnut as the wick. The walnut burns.


CANDLE LIGHTS WHEN TOUCHED WITH WAND
WAND DIPPED IN SULPHURIC ACID
H_2SO_4
THEN TOUCHED WITH POTAS. PERMANGANATE BEFORE LIGHTING CANDLE

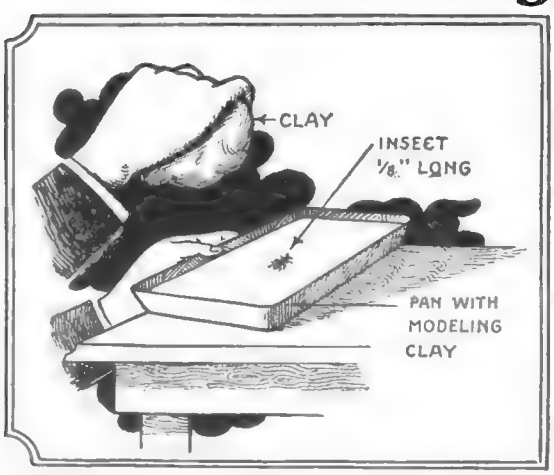
The performer touches the wick of a candle which has just been blown out with a wand, and it immediately relights. The wand is a glass rod dipped in sulphuric acid and potassium permanganate.

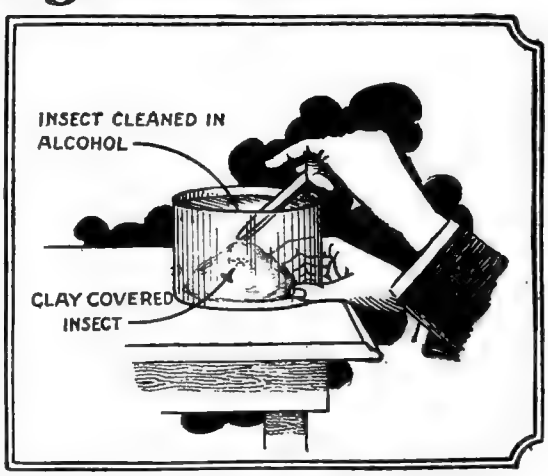


An ice candle which will burn is made by sticking together equal parts of water and ether in a test tube, and immersing it in a freezing mixture of ice and salt.

—Chas. D. Tenney

Entomologist's Mounting Method





In the case of many smaller insects, extreme trouble is encountered in mounting them for study, since when they are killed by the ordinary method of chloroforming them, the insect in the death throes loses its natural shape because of muscular contraction. For preserving the subject in perfect life form, modeling clay is placed in the bottom of the pan as shown, and the insect is covered with another batch of clay thrown down upon the moving insect at the desired moment. After allowing time for it to die, most of the clay is carefully picked off and the rest is placed in a container of alcohol, and the insect cleaned and mounted for photographing.

—J. G. Pratt

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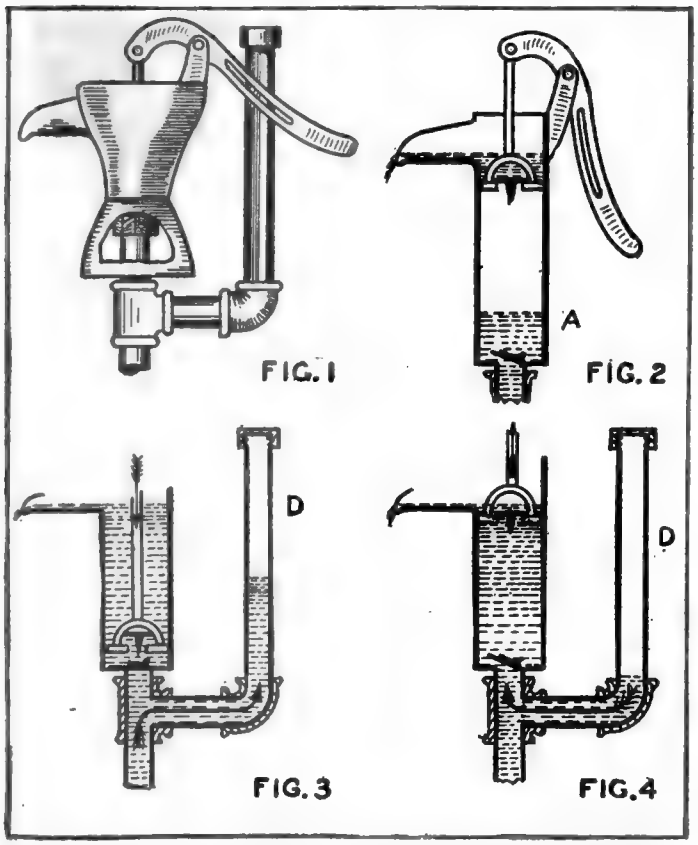
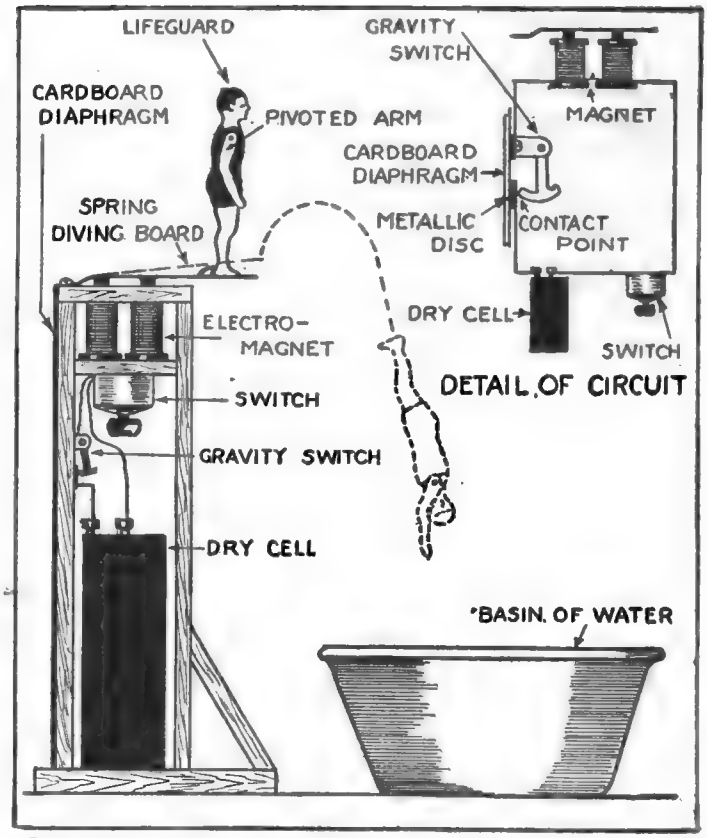
Pump Air Column



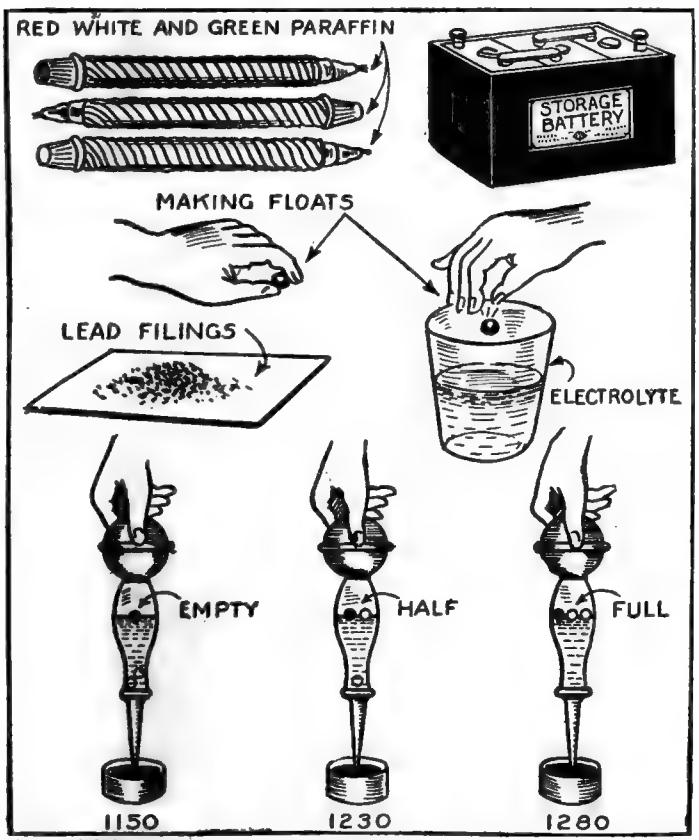
The back suction on a pitcher pump may be removed by the addition of an air column below the lower valve, as shown in the above sketch. Instead of the intermittent flow usual with such pumps, the addition of a simple device will produce a steady stream. —Ben Shilling.

Life Saver



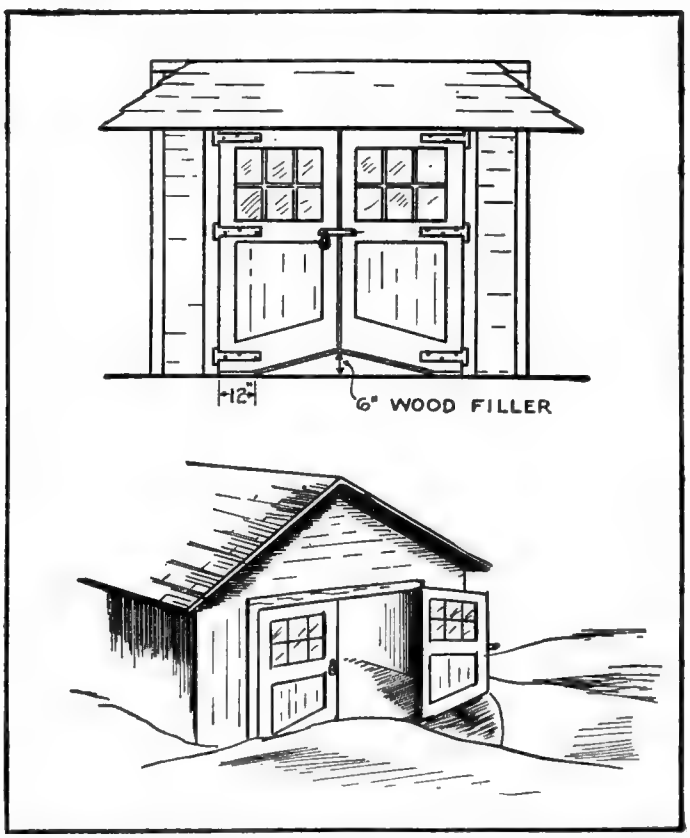
If one yells "help," the cardboard diaphragm in the above toy opens the gravity switch, releasing the magnetic current which holds down the spring diving board, forcing the diver to jump from his perch into the bowl of water as if to the rescue. —Chas. D. Tenney.

Novel Hydrometer



By weighting three balls made of paraffine of different colors with lead filings, so that they float at the charge, half charge, and discharge, specific gravity of storage battery electrolyte, a hydrometer results.—J. T. Graver.

Non-Drag Doors



By placing a triangular piece of wood filler in the center of garage doors and cutting the doors at an angle at the bottom as shown, the annoying drag of the doors on bits of cinders and snow may be obviated.—R. C. Dole.

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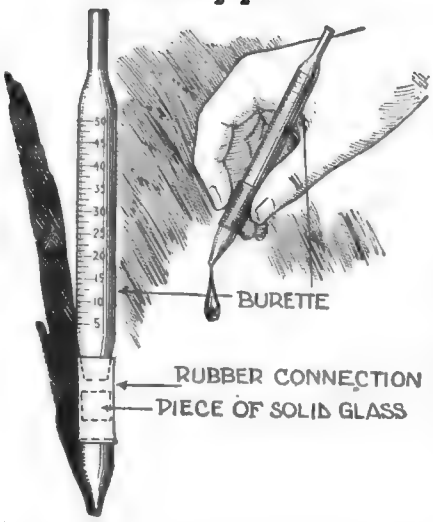
WRINKLES
RECIPES & FORMULAS

Edited by S. GERNSBACK

Rubber Stamp

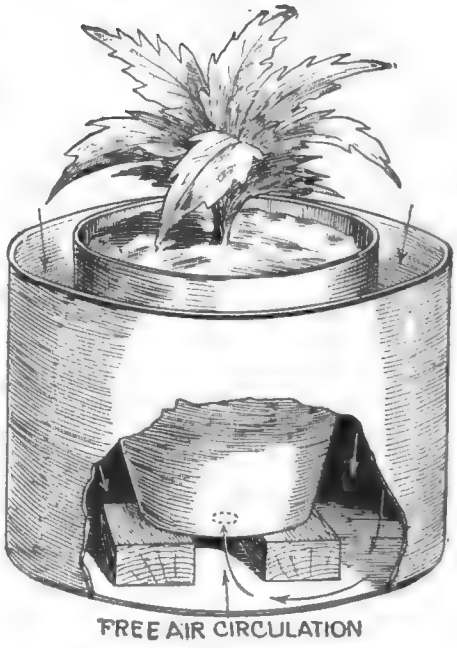
To make a rubber stamp of a coin or other such article, it is only necessary to dust the coin with sulphur, place a tire patch over it, and put the whole in a small vulcanizer.
—C. C. Sorensen.

Dropper



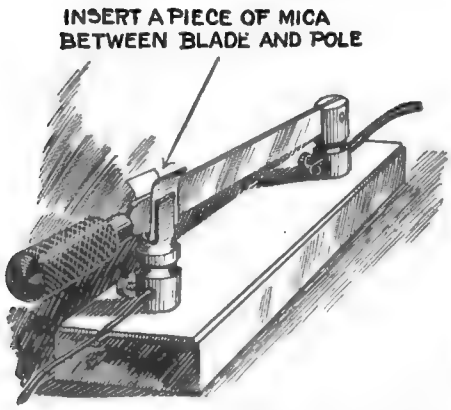
The use of a pinch cock can be done away with and a large improvement made if the above shown kink is employed. A small bit of solid glass is placed inside of a short piece of rubber tubing which is connected to the bottom of a burette. A point is put at the bottom of the rubber tube. To stop the flow, it is only necessary to pinch the rubber.
—F. R. Moore.

Plant Health



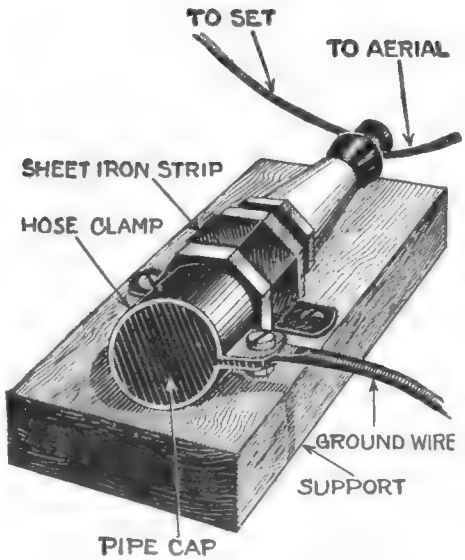
If potted plants are stationed as above, so air circulation is allowed, they will not die or turn yellow so easily.
—W. H. Seitzinger, No. 3826.

Wave Length



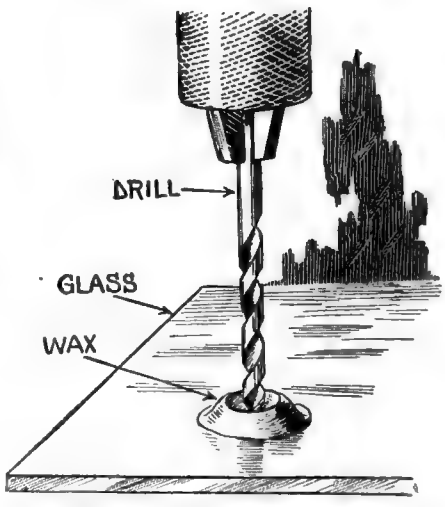
If a small sheet of mica is placed in the aerial switch after the fashion shown above, the natural period of the antenna may be effectively reduced.
—R. L. Young.

Arrestor



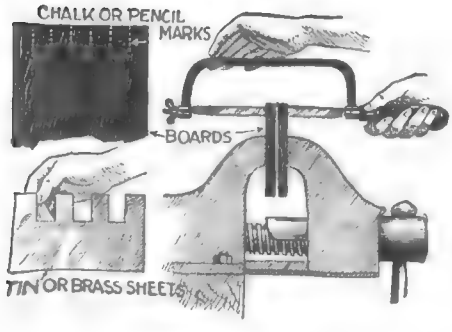
An effective lightning arrestor for radio antenna is made by simply placing a pipe cap on the end of a spark plug and taking a ground connection from it with a hose clamp, and then running the aerial lead to the center electrode of the plug as shown.
—Sterling Davies.

Glass Drill



If turpentine is put into a wax ring surrounding the working point of a drill cutting the glass the latter will not crack.
—(Author please send name.)

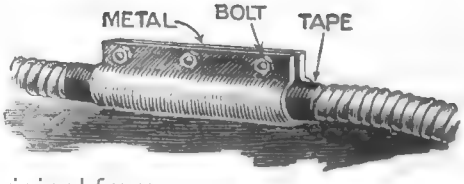
Metal Kink



Left: In working with very thin sheets of metal, it is often extremely difficult to cut them exactly. The method shown at the left is efficient. Place the metal to be cut between thin sheets of wood as shown, and clamp the whole in a vise. Mark lay-out on wood.—I. Kvamme.

Right: For repairing broken speedometer cables, wrap the two ends together with several layers of friction tape, and then to add strength to the patch, bolt a small strip of rather stiff metal over the break, as shown.
—L. B. Robbins.

Cable Repair



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Readers Forum

SCIENCE AND INVENTION desires to hear from its readers. It solicits comments of general scientific interest, and will appreciate opinions on science subjects. The arguments pro and con will be aired on this page. This magazine also relishes criticisms, and will present them in both palatable and unpalatable forms. So if you have anything to say, this is the place to say it in. Please limit your letters to 500 words and address your letters to Editor—The Readers Forum, c/o Science and Invention Magazine, 53 Park Place, New York City.

PERPETUAL MOTION

Editor, *Science and Invention:*

Your letter of Sept. 21 in regard to perpetual motion machine just received. I note you ask for working model to be submitted.

When I wrote you I had been assured by my attorney at Washington that he had looked over the records and found nothing to conflict with my claim and that I had a wonderful proposition, but since then he has made further examination of records and informs me that some person has been granted two patents covering every claim I had put forth. Now that being the case I see no incentive in getting out a model unless it would be to get your $1,000.00 prize.

I feel confident that the machine will work, because the operation of the 24 pumps in no way retards the operating of the wheel or *it requires no more power to revolve the wheel when pumping than when pumps are not pumping.* (*Italics ours. —Editor.*)

I got my idea from an exhibit of frictionless ball-bearings on exhibition at the Gottenberg Sweden Exposition. They run a 10 ton fly wheel mounted on these bearings, using a No. 10 spool cotton thread for a belt and small sewing machine electric motor for power, that being the case I feel confident that a one horsepower motor would operate my 30 ton wheel and compress about 8 cu. ft. of air per minute, which is a record I believe.

Now since the Patent Office has granted two patents on this same machine, without a model, then I should think that your publication would be glad to accept my drawings for competition for your prizes, *especially since I never really claimed perpetual motion for my machine* (*Ours again*).

J. M. B., Seattle, Wash.

(*Unfortunately the editors cannot consider drawings as perpetual motion prize entries.* SCIENCE AND INVENTION *does not hold that a perpetual motion machine was ever made. Many inventors are equally positive that they have invented the system and can demonstrate it.*

SCIENCE AND INVENTION *says, "Show us," and for being shown we offer* $1,000.00 *to anyone who will but merely demonstrate a working model. No patent for a perpetual motion machine, as such, has been granted by the Patent Office during recent years. Perpetual motion was first discredited in the year* 1772. *Up to that year there was no scientist in all of Europe who knew enough to categorically deny that there was such a thing as perpetual motion. Then along came Sir Isaac Newton and De La Hire, a French scientist, who demonstrated without a doubt the impossibility of obtaining perpetual motion. The scientific world was not willing to accept the Newtonian theory immediately, and fully three years later at the French Academy of Science at Paris in* 1775, *perpetual motion was declared an impossibility. The Academy of Science thereby branded all those who still insisted upon experimenting with it as charlatans.*

SCIENCE AND INVENTION *does not brand everybody who experiments with perpetual motion as a charlatan. It does, however, brand everyone who claims to have positively produced perpetual motion as a prevaricator, unless he is in a position to prove by means of an actual demonstration that his machine will do what he claims. For this proof we are willing and anxious to spend the sum of* $1,000.00. *The only requisite is that the machine or model be brought to the offices of* SCIENCE AND INVENTION *Magaine, and shown in an operating condition. The machine must remain here for a time which will permit the original momentum imparted to it to completely die down.*—EDITOR).

MARS AND MARTIANS

Editor, *Science and Invention:*

I have been much interested the past two months in Mars and its opposition to the earth. I read SCIENCE AND INVENTION, and I was interested also in your articles which appeared in the August issue. I am somewhat of a skeptic and would like to ask you one or two questions. You say that scientists agree that the solar system came into being at about the same time. You also say that due to evolution the Martians have developed a much higher civilization and education than ours. Do you account this superiority to evolution alone or were the Martians equipped with a higher order of intellect in the beginning than were the people on earth? The Martians have always been pictured as using a death dealing ray while ours is still in its infancy. One more question. If the earth is still in its cooling process does it give forth heat and light of its own or like the moon does it merely reflect the rays of the sun?

ROBERT SWEETMAN, Y. M. C. A.,
Racine, Wisconsin.

(*In answer to your inquiries concerning Mars, it is our opinion that the reputed greater development of the Martians, if they do exist, is entirely due to their older civilization, or a matter of evolution, considering it from the basis that their planet cooled long before the earth did. It is also our opinion that the Martians were not blessed in the first place, with any higher intellect than that possessed by earth dwellers. If their intellect is greater, it is due to environment and length of time* (*millions of years*).

Regarding the earth giving forth radiant heat, this is not noticeable to other dwellers in space, if such there be, and any light that would be seen from our globe would be due to reflected light, the same as in the case of the moon.—Editor.

PERPETUAL MOTION AGAIN

Editor, *Science and Invention:*

In your reply to S. V. Boatman in your SCIENCE AND INVENTION for August, 1924, I note that you will pay $1,000.00 to anyone merely demonstrating a working model of this device which will operate in your offices.

Now what do you mean by "this device?" Do I understand you to say that if this device of Mr. Boatman is developed and runs satisfactorily in your office, you will pay $1,000.00?

Or, will you pay this amount of money to anyone who will demonstrate a working model of self motive power of any design?

I am now applying for a Canadian patent for a wheel to run by gravity. Technically, I believe as others do that perpetual motion is impossible, but not as far as mechanical movements are concerned. This is probably what you had reference to in your "working model." I think that this is quite possible, as one only needs to see my drawings to be convinced that this is so. Now what degree of efficiency does a self-motive power need to produce to come within the category of your offer of $1,000.00? In my study of the self motive power, my object has been to produce a machine that will be of value commercially. I am quite satisfied I have accomplished my object.

JNO L. CASE.
Windsor, Ont.

(SCIENCE AND INVENTION *Magazine will pay* $1,000 *to anyone who will demonstrate any kind of a perpetual motion machine or a model of it at the offices of this magazine. The amount of power which the machine develops is immaterial. The motor must run and it must remain at the offices of* SCIENCE AND INVENTION *for a time sufficient to permit the original momentum imparted to it to die down. If, therefore, the machine is started at a very slow speed, and it gradually picks up in speed, indicating that power is actually being developed, the perpetual motion motor need not be left here for twenty-four hours. This prize offer holds good for you and any other perpetual motion inventor regardless of where he may be, or what his machine may be like.* SCIENCE AND INVENTION *Magazine denies that perpetual motion has ever been invented. Many of its readers claim to have actually produced such a machine, but they wouldn't care to show the working machine unless they received some compensation for their trouble. We are, therefore, offering the compensation; not only that but we are willing to give such a machine a notable amount of publicity if the inventor so desires.—Editor.*)

The Experimenter

has come back! If you are one of the one hundred thousand readers of the old ELECTRICAL EXPERIMENTER, you will no doubt be glad to hear that the EXPERIMENTER is coming back BIGGER AND BETTER THAN EVER. Beginning with the November issue PRACTICAL ELECTRICS has been changed into an entirely new kind of magazine entitled

The Experimenter

In this magazine which has been greatly enlarged in point of contents, illustrations and circulation, you will find the following new departments:

Experimental Radio
Experimental Chemistry

There is an entirely new treatment of radio containing experiments only. *90% of the magazine contains pure experiments* written by the foremost authorities in their respective fields, also a monthly editorial by the writer.

A fine roto-gravure section is now added to brighten up the magazine. *If you want experiments, this is your magazine.*

Be sure to reserve a copy from your news-dealer before the issue is sold out. THE EXPERIMENTER will be on sale at all newsstands beginning November 20th, 1924.

Hugo Gernsback
Editor

MARTIAN EVOLUTION

Editor, *Science and Invention:*

In a recent edition of your magazine you published an article called, "Evolution on Mars." In this article Mr. Gernsback said, "Having attained a far more advanced civilization, performing all work by machine and hardly ever attempting manual labor, the Martians' arms have shrunk until they are little more than bones with skin covering them. The body weighing much less on Mars and the Martian probably moving around only in mechanical contrivances, his legs have become almost useless and are, therefore, similarly attenuated. They also have but tiny muscles covered with skin."

I thoroughly disagree as to this. We, in our present state of mental development, realize the necessity of proper physical development, and exercise to attain this necessity; and is it not logical to believe that two million years hence, the people will realize the need for physical development even more strongly?

JAMES BRIDGE, JR.

(*No one will question the fact that the Grecians were developed physically to a greater perfection than modern man. Mentally, however, they were inferior to the modern fourteen year old boy. We are sure that you wouldn't care to class Milton, Lincoln, Wilson, Voltaire, Tesla, Ford or Steinmetz as second Hercules. Of course we have leaders in the field who were well built. Washington, Napoleon and Roosevelt had well formed physiques. Nevertheless the fact remains that modern man is muscularly inferior to the Piltdown or Neanderthal races and without a doubt several thousand years from now our hands will become smaller and our muscles very much attenuated through disuse. Any organ in the body which is not used becomes small and weak. Disuse repeatedly through ages will cause a decrease in the sizes of those organs which are not used. In view of the fact that development started on Mars hundreds of thousands of years before it started on this earth, and assuming that the development progressed at the same rate of speed, the tendency is that the Martian man,—if there is such—has much more slender limbs and muscles.—Editor.*)

BOOST FOR "A MEDICO"

Editor, *Science and Invention:*

I have been a constant reader of SCIENCE AND INVENTION for several years and have always given it preference in the realm of popular scientific magazines. I am a Sophomore in the Engineering College of the University of Florida, studying electrical and chemical engineering. I am preparing for the profession in the research engineering, and am naturally very much interested in the latest scientific developments. I approve very much of the "Science-in-picture" policy of SCIENCE AND INVENTION, and I think that the advent of the Readers' Forum is a very commendable step.

I wish to present a brief discussion of several of the articles of the Readers' Forum in the September SCIENCE AND INVENTION. In regard to "Smells on Mars." I am inclined to the theory advanced by "A Medico," that the propagation of odors in a rare atmosphere would be more rapid than in a dense atmosphere. Your quotation from Mr. Chapin supports my theory. Also your quotation from Mr. Burgess states that the power of diffusion is influenced in the opposite way from that in which convection is influenced by decreased pressure. Now I hold that, under ordinary conditions of convection currents either here or on Mars, the decreasing rate of propagation of odors by convection with decrease in pressure is in general compensated by the rapid increase in the rate of propagation by diffusion. Let us apply the theory of limits. As the pressure approaches zero, the rate of propagation of the odor by diffusion approaches the actual velocity of the molecules of that gas as a limit. For the lightest gas, hydrogen, the average velocity of the molecule at zero degrees centigrade is about 5,500 feet per second, and for a comparatively heavy gas, such as chlorine, the average velocity of the molecule is about 925 feet per second, or 630 miles per hour. Now even this last value is far above the velocity of an ordinary

(*Continued on page* 843)

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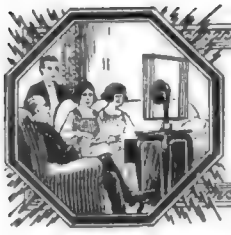
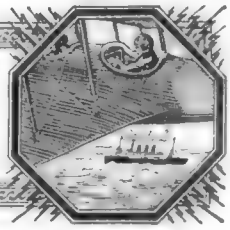


RADIO



Night Transmission of Radio

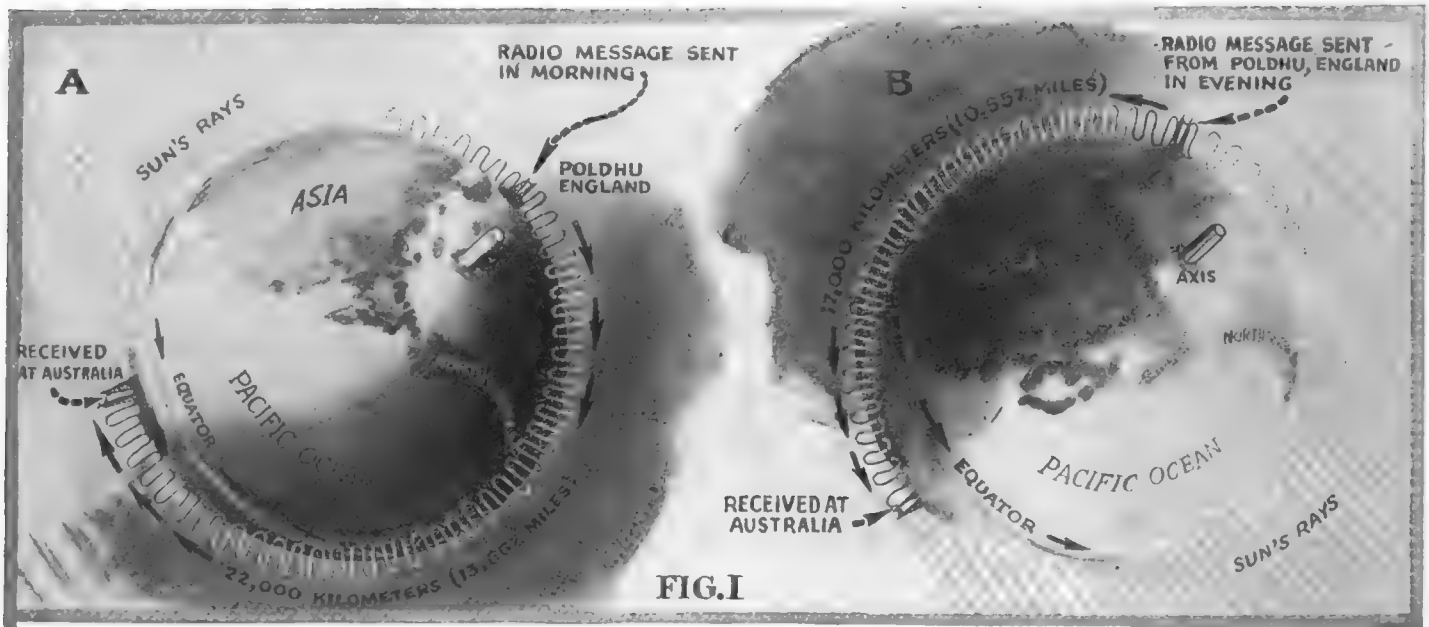


FIG. I

In a series of recent experiments, Marconi demonstrated that radio waves subject to the sun's rays over a great distance are nearly entirely nullified. In the tests, communication was held between the powerful station at Poldhu, England, and at a receiving station in Australia. It was found that if the signals were sent in the morning, they covered a distance of 22,000 kilometers, reaching Australia by way of the Atlantic and Pacific Oceans, while during the evening, the signals travelled a distance of 17,000 kilometers.

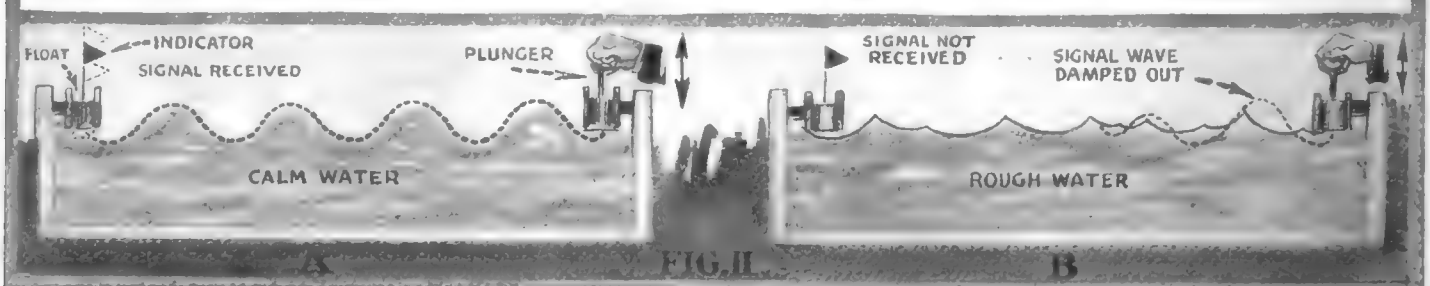


FIG. II

A simple physical analogy of the creation of sustained waves of constant amplitude is shown above. In calm weather, the undulations are transmitted and received—the interpretation being distinct and clearly defined. But, if there is a storm raging on the surface of the water, the signals will quickly damp out and communication will be impossible. In the same measure that storm waves act on calm water, the magnetic and gravitational waves act on the ether. Solar phenomena are responsible for magnetic disturbances on our sphere.

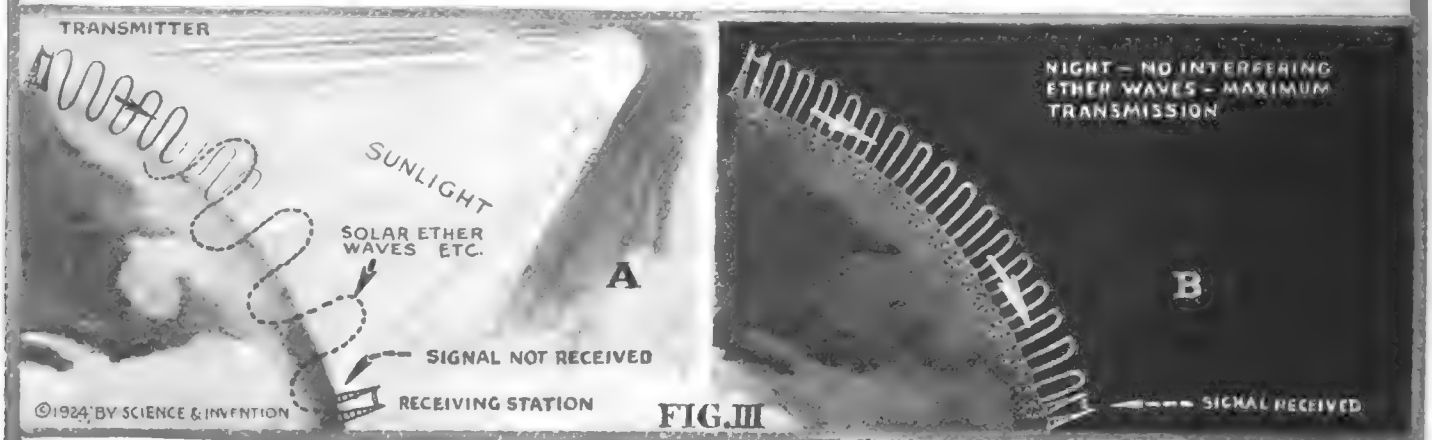


FIG. III

Upon measurement of the wave-length of the solar ether waves, many were found to be in the proximity of 2,000 meters. If a transmitting station were working on that wave-length, the more predominant waves from the sun would completely absorb the transmitted wave so that reception becomes impossible. Hence, the wave passes around the other side of the earth and, as it were, reaches its destination. The signal strength of the wave is not increased by night transmission, but in the absence of a disturbing medium, it travels freely.

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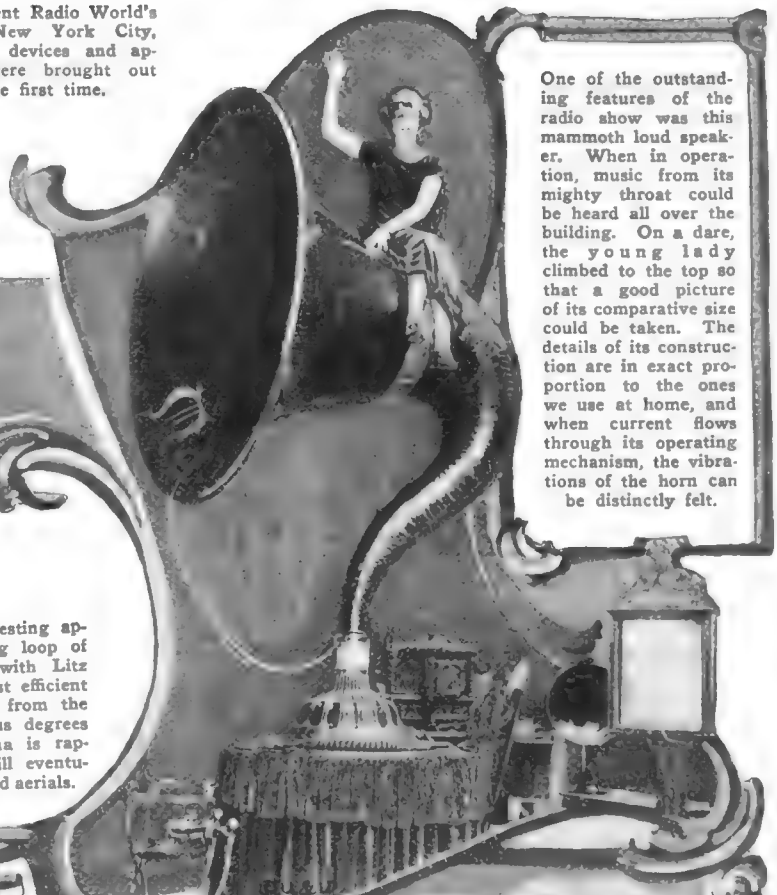
Gigantic Radio Show in New York

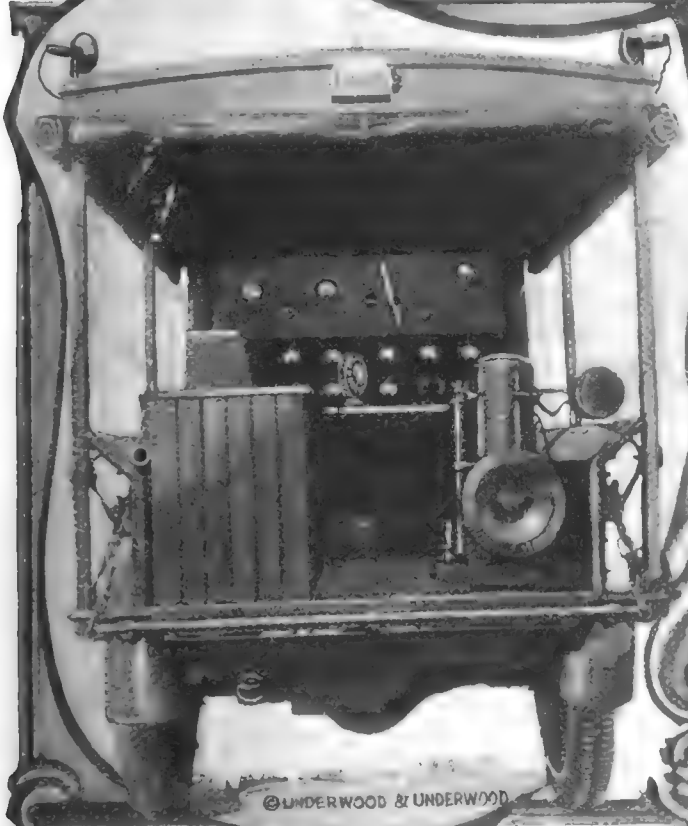
ALSO LATEST DOINGS AT THE BROADCAST STUDIOS

At the recent Radio World's Fair in New York City, many new devices and appliances were brought out for the first time.

Among the many new and interesting apparatus was a collapsible folding loop of German manufacture. Wound with Litz wire, it is claimed to be the most efficient loop made; a radical departure from the conventional type offering various degrees of selectivity. The loop antenna is rapidly coming to the fore and will eventually, replace the unsightly backyard aerials.



One of the outstanding features of the radio show was this mammoth loud speaker. When in operation, music from its mighty throat could be heard all over the building. On a dare, the young lady climbed to the top so that a good picture of its comparative size could be taken. The details of its construction are in exact proportion to the ones we use at home, and when current flows through its operating mechanism, the vibrations of the horn can be distinctly felt.



WJAZ, the former well known Chicago station, has now become a transient. In order that interference in the congested ether around the Windy City may be alleviated to some degree, the owner of WJAZ has placed it on a truck, thus making it a portable broadcast station, which is being operated within a radius of 100 miles from the city.

The hectic days of the French Revolution with all its fearsome chaos and revolutionary din were recently reproduced in quite an elaborate fashion. Thousands of radio listeners were able to visualize the great catastrophe that took place in the latter part of the 18th century and were thrilled unto the very marrow. The fall of the Bastile was radiocasted with amazing fidelity.

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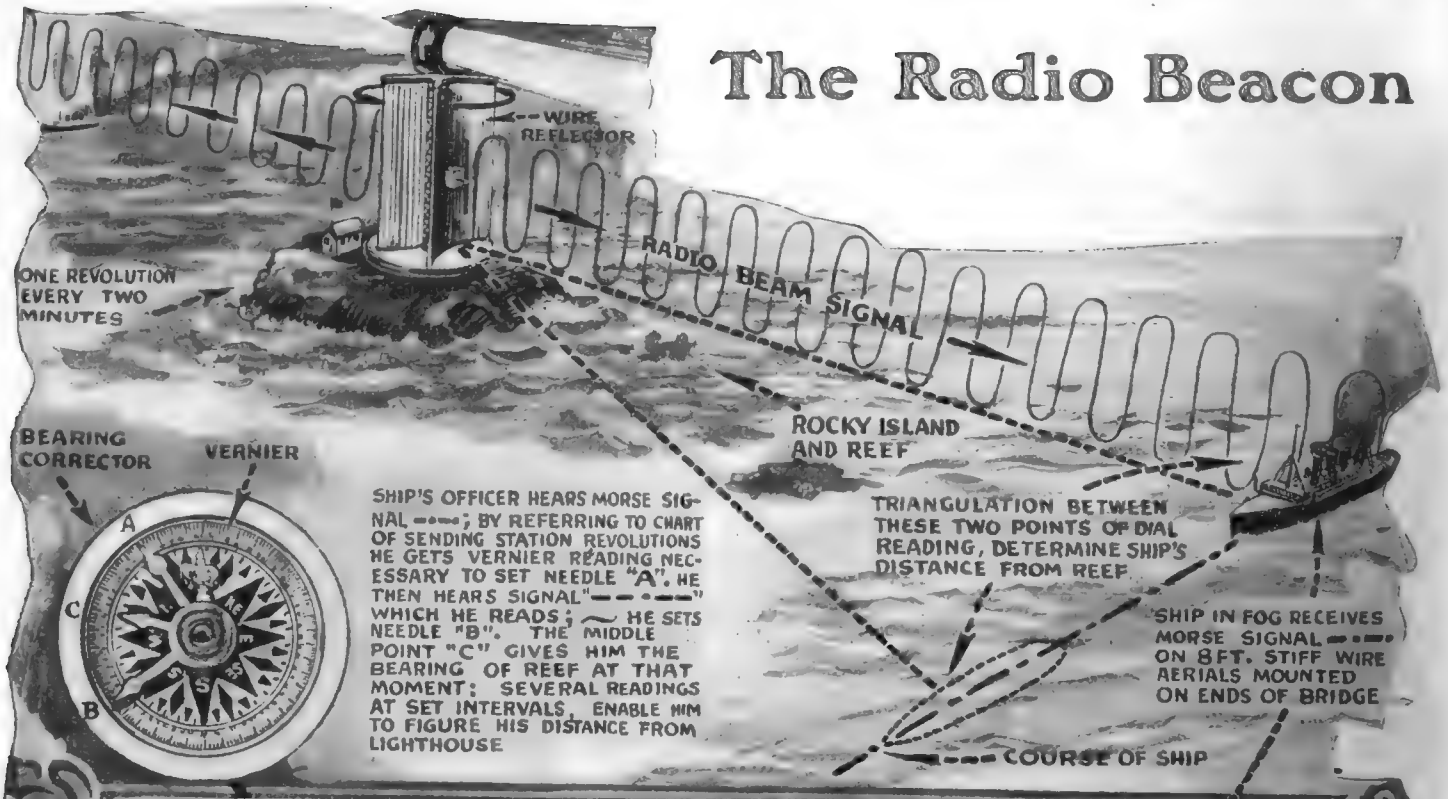
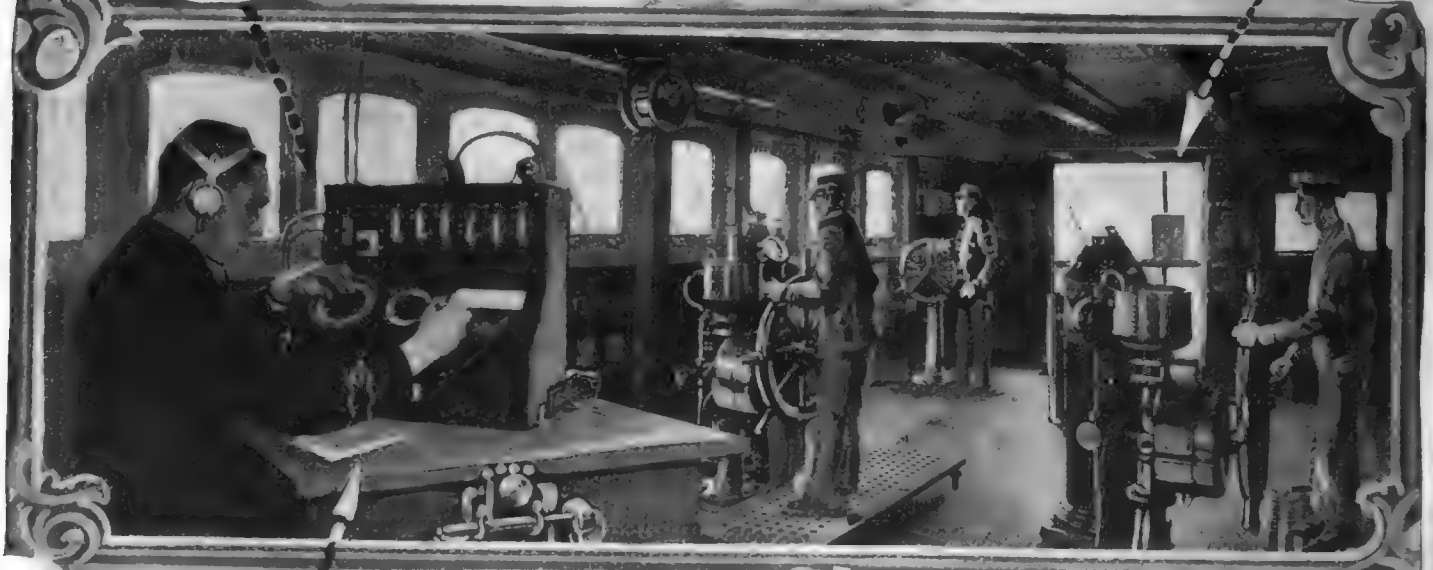
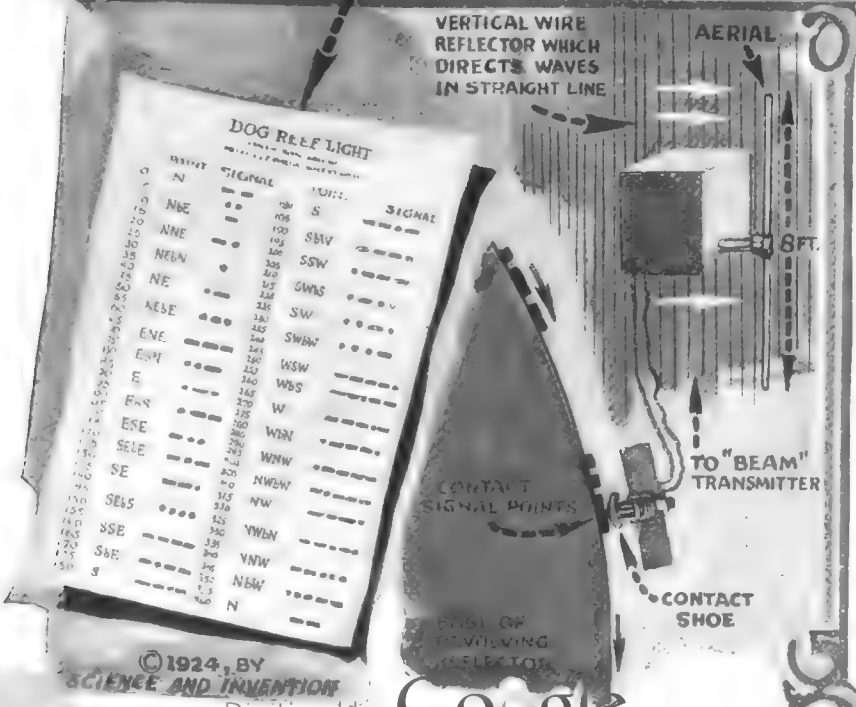
The Radio Beacon


WIRE REFLECTOR
ONE REVOLUTION EVERY TWO MINUTES
RADIO BEAM SIGNAL
ROCKY ISLAND AND REEF
BEARING CORRECTOR
VERNIER
A
B
C
SHIP'S OFFICER HEARS MORSE SIGNAL --•--; BY REFERRING TO CHART OF SENDING STATION REVOLUTIONS HE GETS VERNIER READING NECESSARY TO SET NEEDLE "A". HE THEN HEARS SIGNAL "--•--" WHICH HE READS; ~ HE SETS NEEDLE "B". THE MIDDLE POINT "C" GIVES HIM THE BEARING OF REEF AT THAT MOMENT; SEVERAL READINGS AT SET INTERVALS, ENABLE HIM TO FIGURE HIS DISTANCE FROM LIGHTHOUSE
TRIANGULATION BETWEEN THESE TWO POINTS OF DIAL READING, DETERMINE SHIP'S DISTANCE FROM REEF
SHIP IN FOG RECEIVES MORSE SIGNAL --•-- ON 8FT. STIFF WIRE AERIALS MOUNTED ON ENDS OF BRIDGE
COURSE OF SHIP





WITH the perfection of directive short wave transmission, the radio beacon becomes a possibility. A rotating lighthouse is constructed in the vicinity of dangerous reefs and is equipped with a short wave set which is made directive by the use of parabolic wire reflectors. By placing a series of contacts along the revolving periphery attached to the base of the lighthouse, signals corresponding to the points of the compass are continuously sent out. Thus, a ship in a heavy fog receives a certain signal at one position. Another reading five minutes later gives still another position. By referring to the compass, it becomes posssible to obtain the ship's exact bearing and by the simple method of triangulation, the distance from the dangerous rocks is quickly made known. By the use of an international code chart, ships will be perfectly safe from grounding or going upon shoals in unknown foreign ports. So accurate is this means of measurement that the errors are found practically negligible and in all cases the readings were accurate. Not only is radio becoming indispensable in ship-to-ship and ship-to-shore communication, but each day finds new uses for its application and certainly the radio beacon will be welcomed by all sea-faring men.

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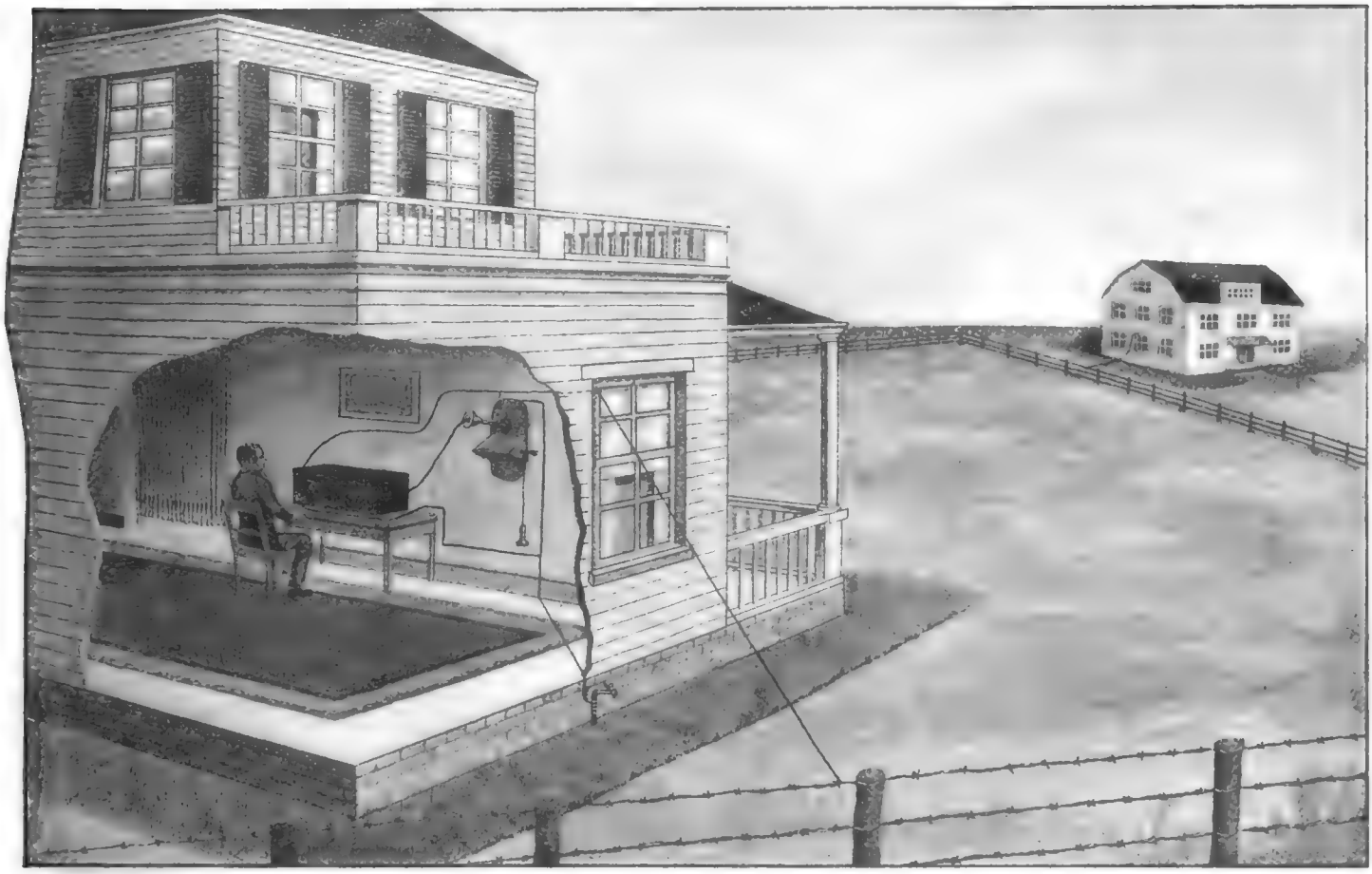
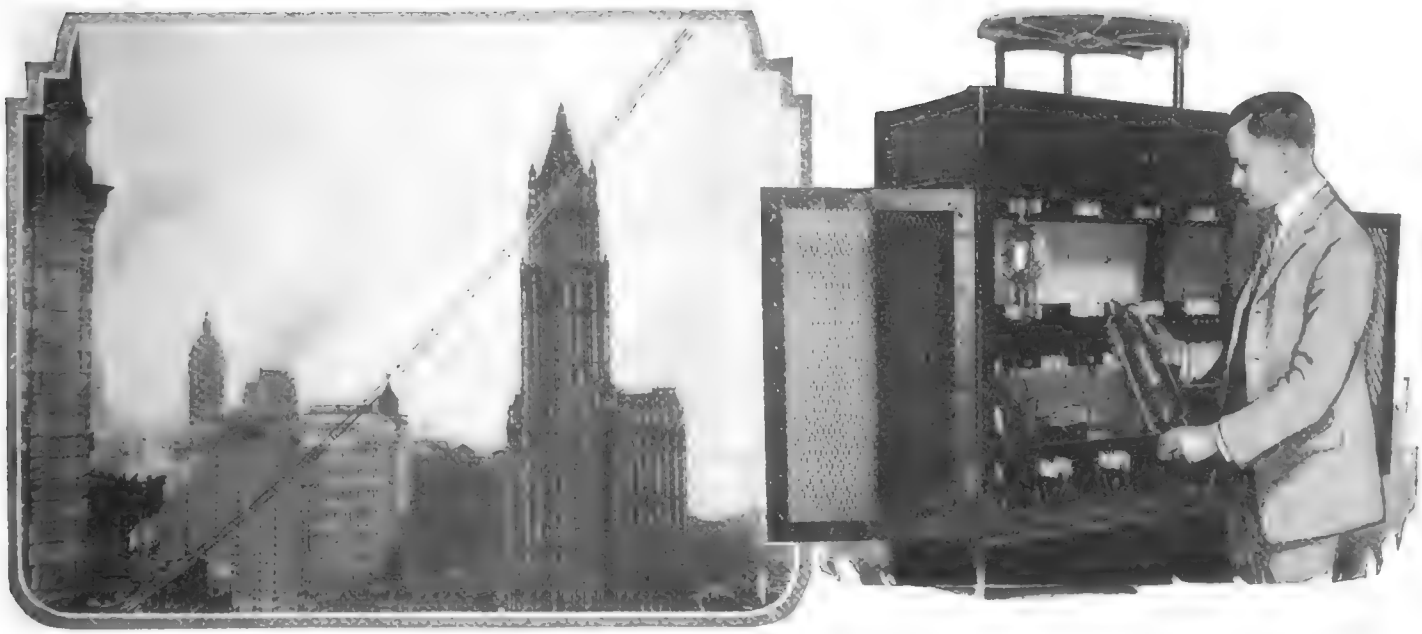
Radio by Telephone

USING AN AERIAL AS A TRANSMISSION LINE



Widely separated farm houses are now brought more closely together by utilizing the uppermost wire of the fence that runs close by. The wire is used as an antenna and is connected to the ordinary receiving set in the usual manner. The same wire is also used as a telephone transmission line between the houses. Music is tuned in on the radio set, the headphones placed in front of the microphone on the wall telephone and the receiver is lifted off the hook. All that is necessary now is to listen in at the other end and enjoy the same concert. This aerial is unique in that both radio frequency and audio frequency signals are conveyed over it without distortion. —Clarence Sampson, Reporter No. 12762.

"This Is Station WNYC—"



The beautiful antenna system of New York's new municipal broadcasting station is shown above with the Woolworth Building gracing the background. Located on top of the lofty Municipal Building, Station WNYC is ranked as one of the most powerful broadcast stations in the country. With a rated input of one kilowatt of power, though surrounded on all sides by tall steel skyscrapers, this station is one of the real first-class broadcast stations to be found anywhere in the world. Many novel features and new developments have been incorporated and with its artistic and well designed appointments, it may be safe to say that it is the last word in broadcast stations. Note the powerful transmitting tubes.

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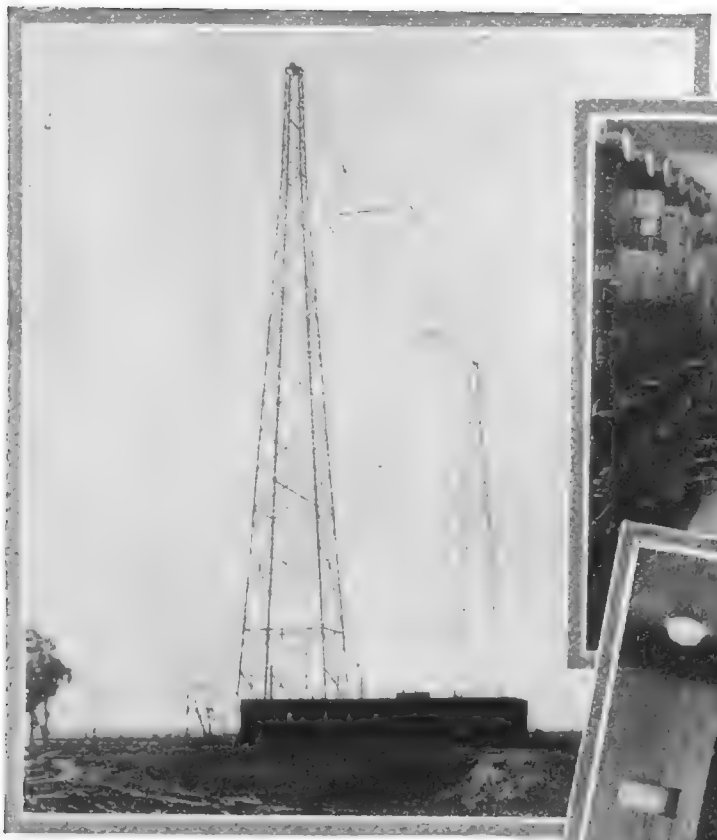
The Broadcasters



The stately towers of station KGO at Oakland, Calif., are shown supporting the huge antenna system from which its programs are sent for a radius of several thousand miles. At the right, the comfortable studio, rich in its appointments and furnishings, is shown, while several artists are rendering popular selections. KGO, one of the most powerful stations in the world, has a wealth of electrical apparatus. Nine motor-generator sets supply the necessary current for the operation of the various apparatus. And every part of the equipment is in duplicate!

Station WIP, located at Philadelphia, has long been known for the highly instructive and interesting programs it carries on its lists of entertainment. A powerful speech input amplifier is one of the outstanding features of this station which has been heard far and wide. Broadcasting on 509 meters, the public spirit manifest in the operation of this station is commendable.

The future of broadcasting indeed looks very promising. The welfare of a station depends in a great measure upon the enthusiasm with which its programs are received. Every day finds constant changes being made in the repertoire of our indispensable harbingers of joy. It seems to be that the struggle is not merely between the smaller stations, but between the larger ones as well. Each one is striving to produce the better program and to attract more listeners to its fold. Gradually the poorer stations are dropping out and the better ones are being improved. In the course of a few years it may be safe to state that radio broadcasting will become centralized.

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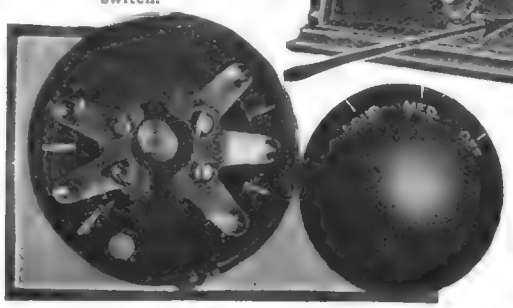
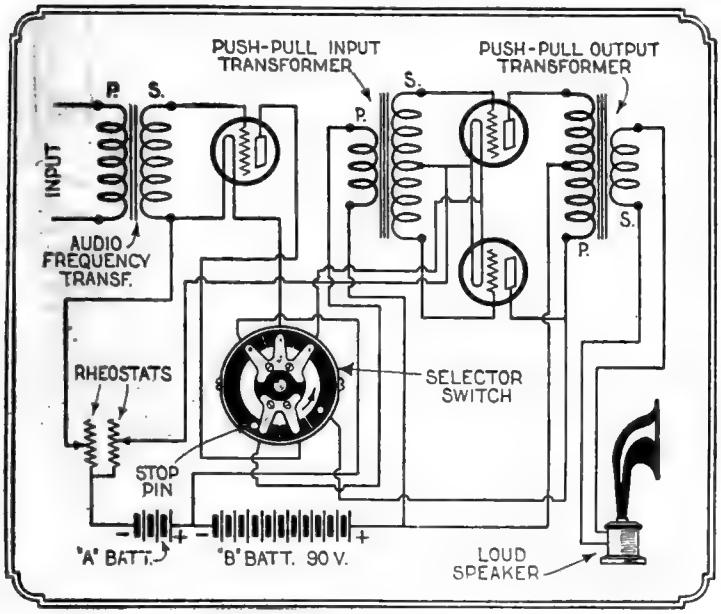
Switch Replaces Jacks

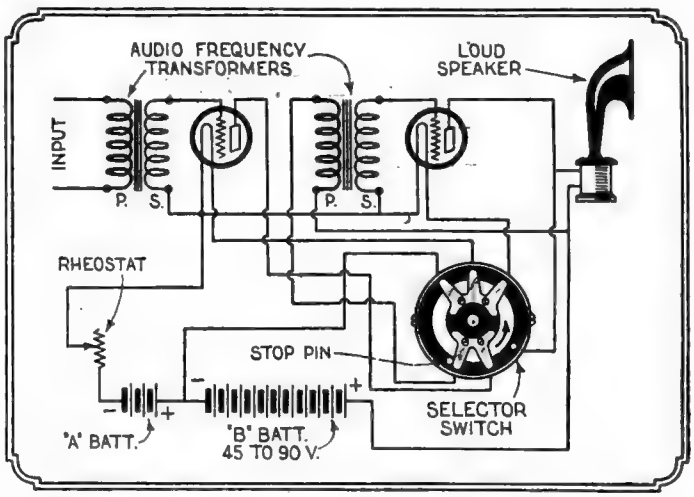
A SELECTOR switch that obviates the necessity of all jacks has recently been incorporated on the receivers manufactured by a well known radio concern. It is simple in construction and substantial in its rôle. By its use, the elimination of the "A" battery switch and automatic filament control jacks with all their attendant disadvantages, is accomplished. Made of genuine molded black bakelite, it gives the best insulation between successive stages of amplification. Besides doing away with the unsightly appearance of jacks, it greatly enhances the beauty of a receiver.

Another step forward in the simplification and standardization of radio sets is the selector switch.



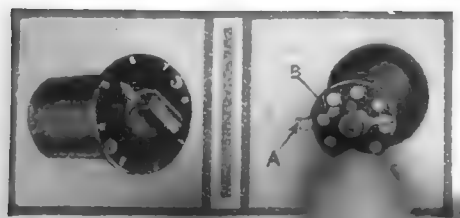
At the left is shown the controlling mechanism consisting of a 2 and 3 fingered switch-lever. There are three positions of the controlling knob, LOUD, MEDIUM, and OFF. How much better than intricate jacks! Only six connections are required and they are facilitated by the use of small binding posts, and soldering lugs.





The switch is shown in use in a push-pull and straight audio frequency amplifier circuit. In its OFF position, both the "A" and "B" battery circuits are open and danger of running down these batteries is entirely eliminated. On MEDIUM, all except the last tube are lit, while on LOUD, the output of all tubes is conveyed through the loud speaker.

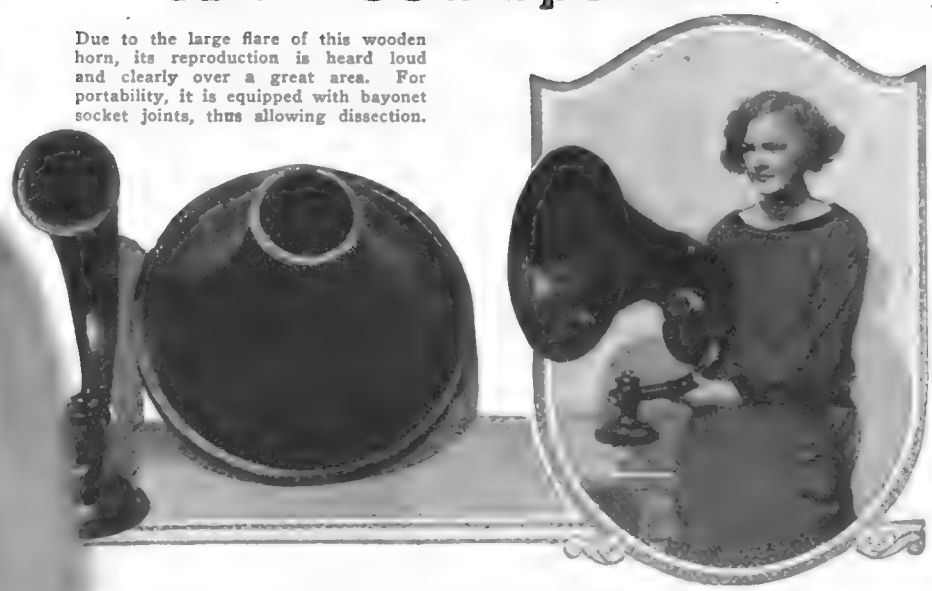
English Devices



A tuned radio ... cy tra... ...se wave-length ra... ... alte... switch has rec... ...pla... ish market. I... ...atur... adaptability to ... ...nge

All Wood Speaker

Due to the large flare of this wooden horn, its reproduction is heard loud and clearly over a great area. For portability, it is equipped with bayonet socket joints, thus allowing dissection.



...ht out by a German manufacturing firm, this loud speaker horn made entirely of lami... wood is bound to appeal to those who desire the resonant qualities of both low and ...notes reproduced in pure rhythmic fashion. No metal whatsoever is used in its con...tion and it is truly a remarkable piece of workmanship. Its superb tonal qualities com...e to the Stradivarius, makes it an unexcelled instrument, far surpassing those on the ... today. Note the graceful lines of this beautiful horn which greatly amplifies the faintest sounds with remarkable fidelity, as tests in our offices proved.

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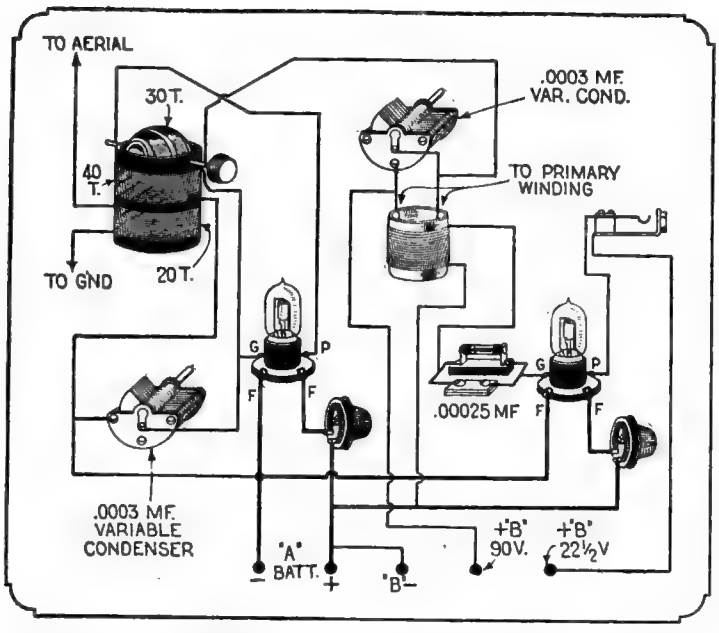
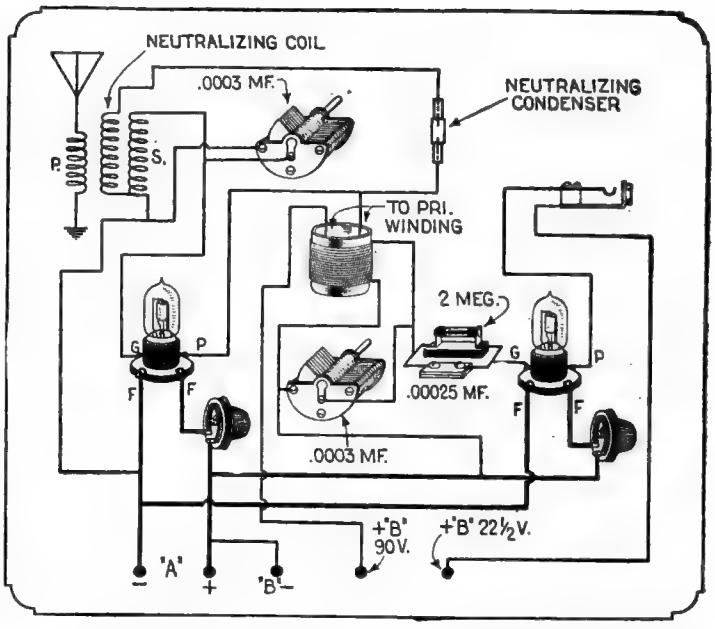
Neutralizing Methods

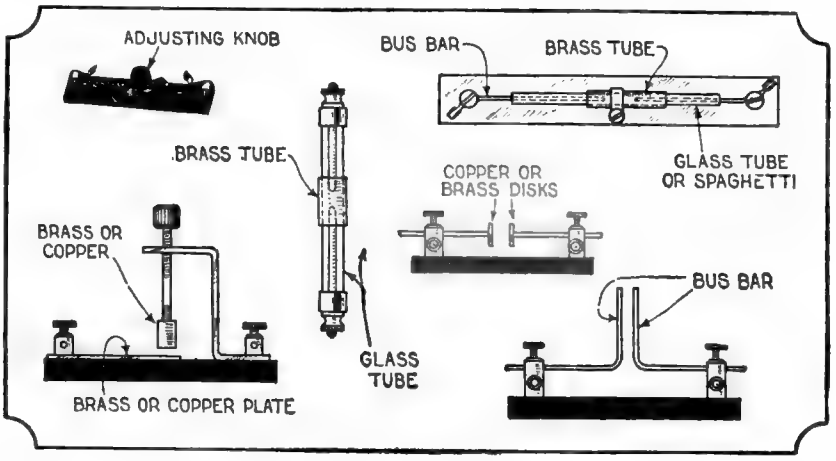
PART II

By LEON L. ADELMAN, A.M., I.R.E.

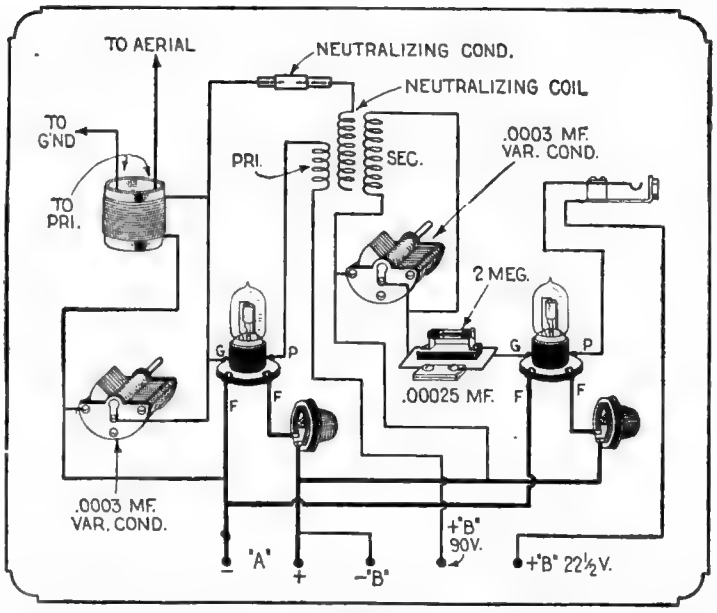




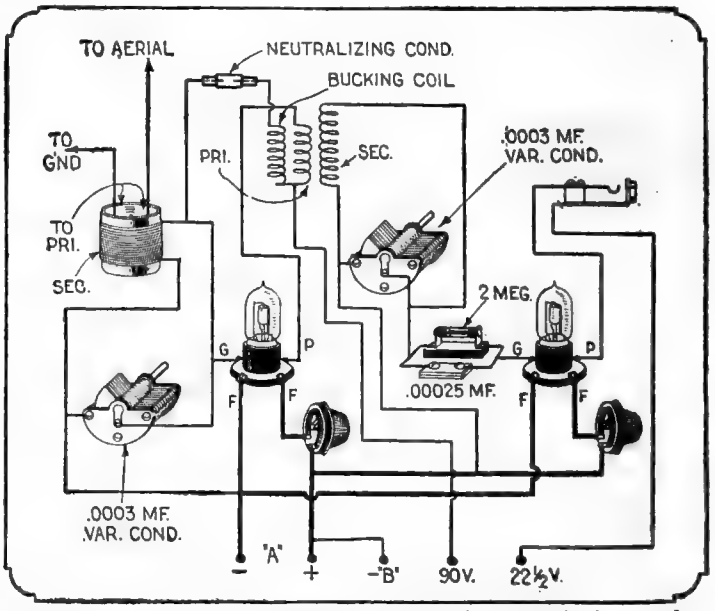
With the ever increasing popularity of the Neutrodyne receiver, there has been a great development in methods for neutralization. It must be remembered that neutralization is that process by which the internal capacity of a tube is offset or neutralized. Once a tube is neutralized, the circuit in which it is in, is spoken of as neutralized. Diagram No. 1 shows a simple method of preventing oscillations from being set up. It is known as the reversed feed-back method, a counter EMF being induced in the secondary circuit by the proximity of the reversed tickler coil.



If a third coil is wound directly over the secondary of the vario-coupler, and connected as is shown in the above diagram, enough losses are introduced in the entire circuit so that the generation of undesirable oscillations are alleviated. While the circuits shown on this page employ but one stage of tuned neutralized radio frequency amplification, as many as four stages can be successfully employed. There are many neutralizing condensers or so-called neutrodons on the market, some of them being shown herewith. Essentially their construction is varied, but their operation always remains the same.



It is a proved fact that a neutralized tube will receive from a greater distance than one used in a straight radio frequency amplifier circuit. Whereas perhaps the Hazeltine method is the simplest and the best, the above adaptation will function in a thoroughly commendable manner. It utilizes a tertiary inductance in the form of a coil of wire wound directly on the secondary of the neutroformer. One end of the coil is dead-ended, while the other can be connected in series with a neutralizing condenser to the grid of the first tube. The neutrodon in this case is not a requisite.



Perhaps one of the most interesting ways in which neutralization can be obtained is through the use of what is known as a bucking coil, a third winding of the same number turns as the primary of the neutroformer and wound directly over it. Fundamentally, it can be seen that the arrangement is analagous to the opposing rotor and stator of the variometer. For an experiment, the testing of the circuits shown on this page are extremely interesting and instructive. It must be borne in mind that the word "Neutrodyne" does not imply any but the Hazeltine method.

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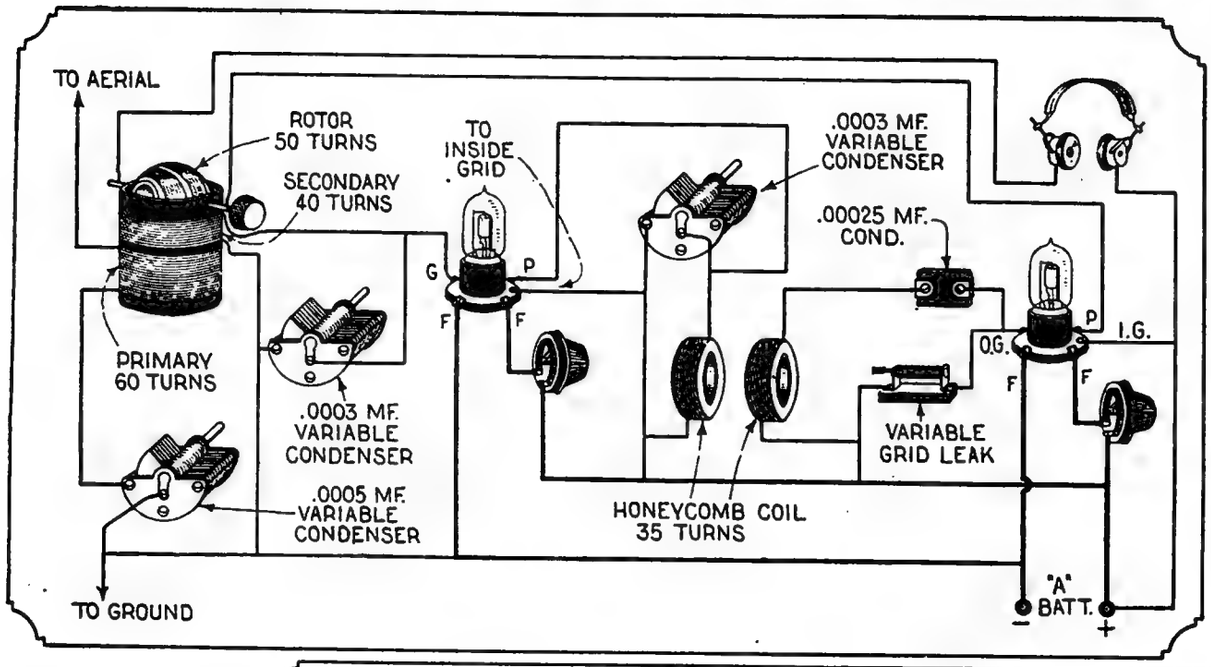
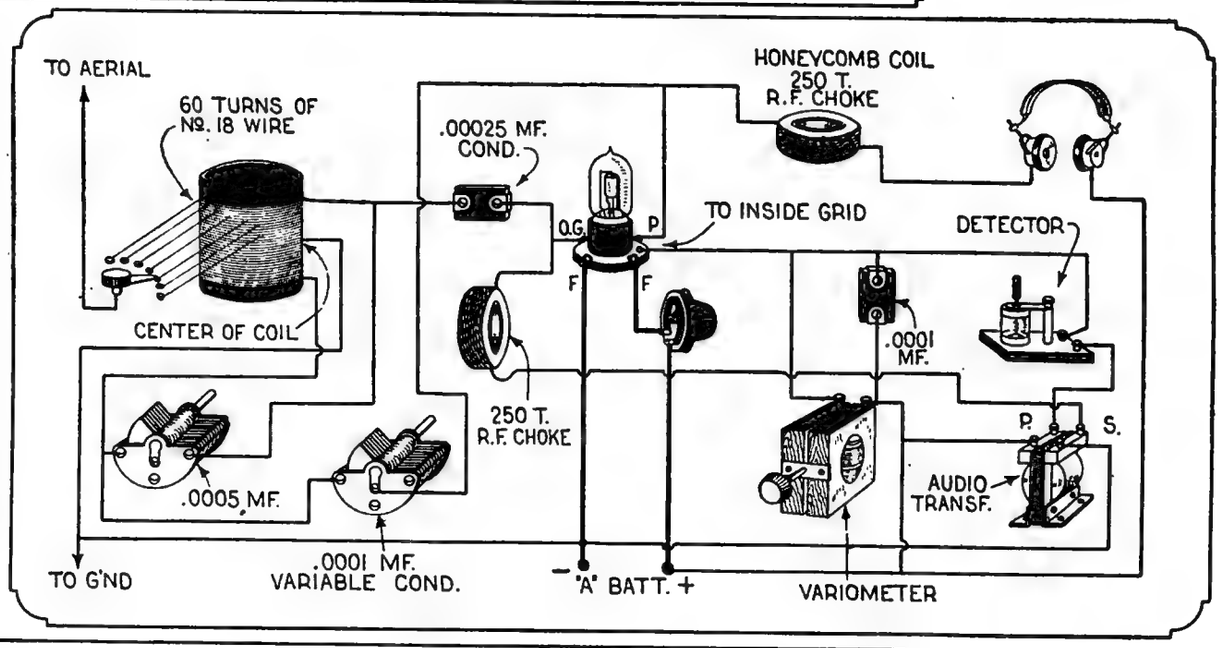
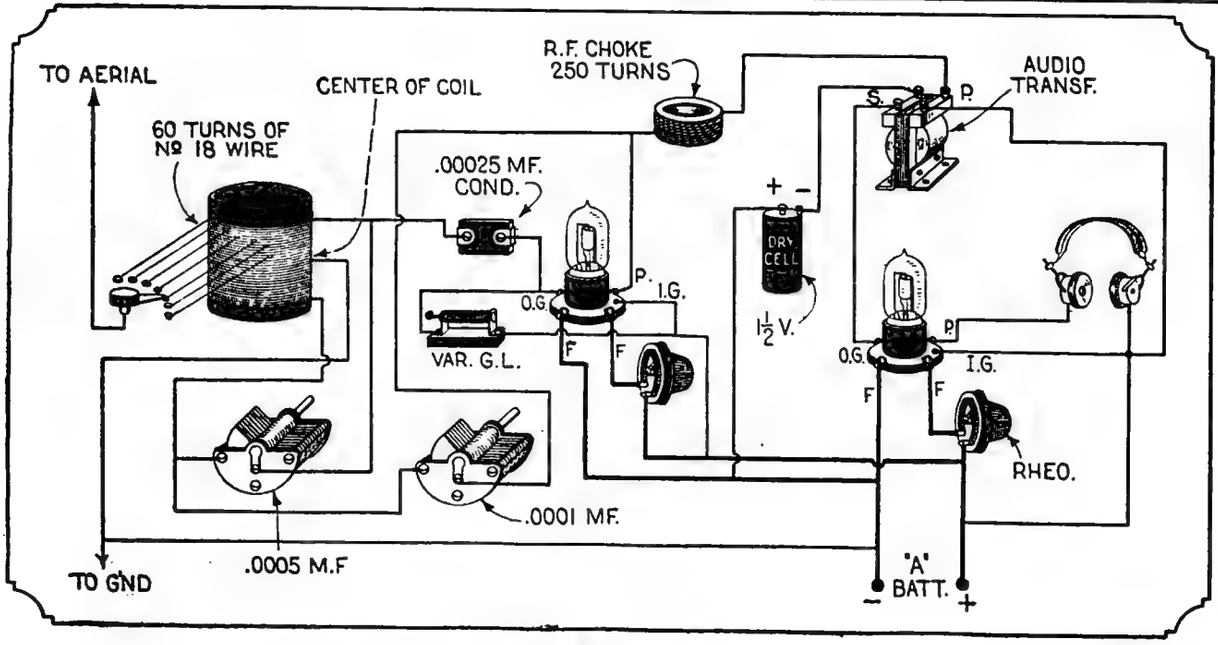
Three Solodyne Circuits



Having passed the experimental stage, the Solodyne is fast finding popularity with those radio experimenters who desire crystal-clear reproduction. Herewith is shown a circuit utilizing tuned radio frequency and combining regeneration. As is evident, four element tubes are used. By their use, the elimination of the "B" battery is effected. Instead of the honeycomb coils shown, other types of transformers can be used, preferably closely coupled spider-web coils. While no specific receiving range can be given, this circuit is good for approximately 1,000 miles.

The Solodyne reflex has shown promising results and can be readily understood from the diagram on the right. By the use of a sensitive crystal detector and a four element tube, a rare combination that gives unexcelled purity in tonal qualities is the result. The primary inductance is tapped at every fourth turn up to the thirtieth or center of the coil. Two radio frequency choke coils in the form of 250 turn honeycomb coils are incorporated, but are not coupled together. A 4 to 1 ratio audio frequency transformer is employed and affords maximum amplification.





The circuit shown is one using the Solodyne principle and consists of a detector and one stage of audio frequency amplification. A "C" battery in the form of a single dry cell materially aids in increasing the volume. It must be remembered that all Solodyne circuits eliminate "B" batteries, and give unexcelled clarity. All that is necessary is a good storage battery giving a constant current to operate the filaments of the newly developed tubes. By carefully soldering all connections so as to prevent needless waste of energy, best results are obtained.

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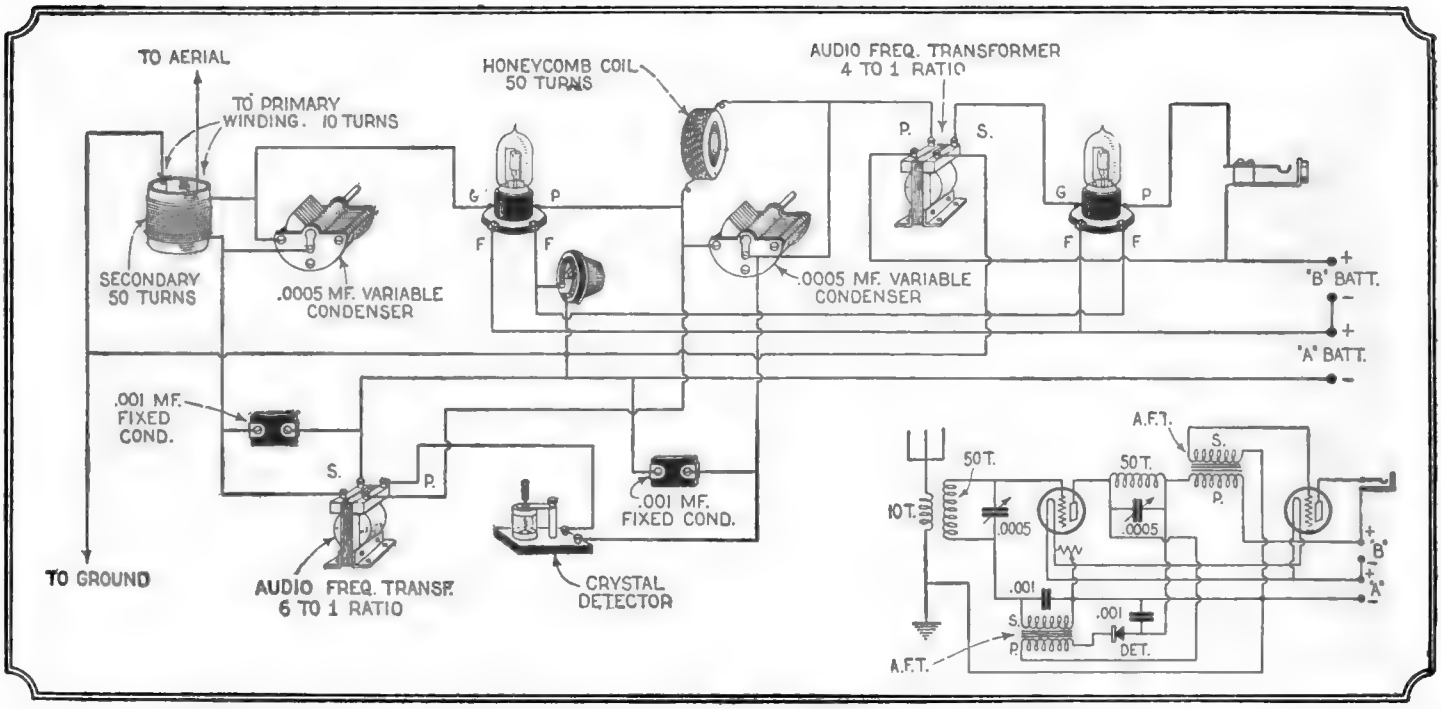
Radio Oracle

In this Department we publish questions and answers which we feel are of interest to the novice and amateur. Letters addressed to this Department cannot be answered free. A charge of 25c. is made for all questions where a personal answer is desired.



A reflex circuit employing two tubes and a crystal detector is shown in the above diagram. The reason for the popularity of the reflex is that it affords considerable saving in the price of expensive tubes. Its quality, when adjusted carefully, is well nigh as perfect as can be, a crystal detector, of course, giving the clearest reproduction. Care must be exercised in the selection of suitable parts and materials. Query No. 317.

REFLEX CIRCUIT

(317) James Rossoff, San Francisco, Calif,. says he has two 201A tubes and a sensitive crystal. He asks:

Q. 1. Can you kindly give me the best hook-up arrangement for these?

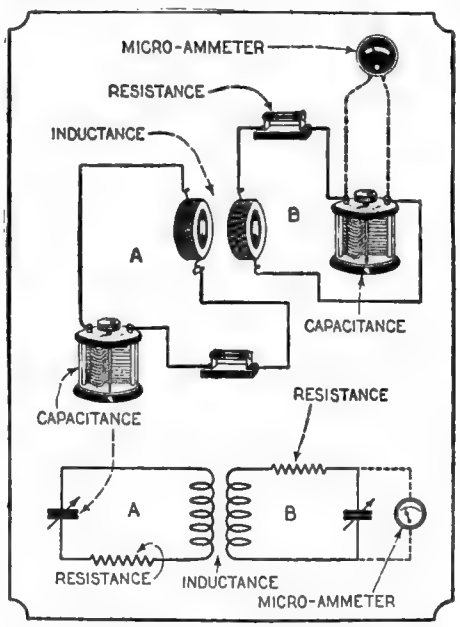
A. 1. The reflex circuit shown in the diagram will serve to get you best results from the use of your apparatus. Care must be taken to see that the crystal is a sensitive one and is kept free from dirt or grease. Such a circuit gives wonderfully clear reproduction since the crystal is the rectifier or detector.

RESONANCE

(318) Hampton Trayner, Idaho Falls, Idaho, asks:

Q. 1. Will you explain briefly what is meant by resonance and how it is effected?

A. 1. Resonance is that condition of harmony between two systems such that natural effects produced by one system on the other are magnified many fold. Thus in Fig. 1, circuit A is an oscillatory circuit containing the two essential conditions of inductance and capacity. The resistance in this circuit can be made small, but will always exist. If a source of undamped electrical oscillations are closely coupled to circuit A, the circuit will begin to oscillate and do so to the greatest degree, when it is tuned exactly to the frequency of the incoming oscillations. The tuning is effected by the condenser. Now, if we bring a similar circuit, B, in close relation to circuit A, it will be shown by the sensitive meter that B will respond to the oscillations in A, when B is exactly tuned to the frequency of A. Fig. 2 shows the curve depicting the signal strength as plotted against the frequency. Here it is shown that at the resonant point, the signal strength is the greatest. Slightly detuning, means that the signal strength falls off very appreciably as is shown by F1 and F2. The effect of resistance is clearly shown in Fig. 3. When the resistance is at a minimum and provided the circuits are in resonance, the current strength is a maximum and tuning is relatively sharp. When the resistance is large, the tuning becomes much broader with an appreciable diminution in signal strength. Again, if the resistance is very high, the circuit will not always oscillate, depending of course on the value of the resistance. However, if the resistance is low enough to allow the circuit to still oscillate the tuning becomes very broad and the so-called peak is not clearly defined. At the same time, the current strength is very small. Thus, in the Neutrodyne, tuned radio frequency is utilized, at the same time the resistance in the circuits is relatively high, thus choking down any persistence towards self-oscillation. In other words, a happy medium is arrived at where maximum amplification can be obtained and at the same time relatively sharp tuning will be allowed.



It must be remembered that maximum signal strength can be obtained by using circuits having low resistance. Thus circuit B will respond to A when both are in resonance, and the micro-ammeter will show a greater reading when the resistance in circuit B is a minimum. Query No. 318.

CURRENT FREQUENCIES

(319) Donald Reynolds, St. Paul, Minnesota, asks:

Q. 1. What are approximately the correct values of frequencies used in the transmission of electrical power, in telephony and in radio?

A. 1. The use of alternating currents may be roughly divided into three groups, separated according to the frequency of the current alternations used. Electric power applications, 20 to 133 cycles per second, telephony, 100 to 20,000 cycles per second and radio, 20,000 to 2,000,000 cycles per second are the groups in question.

WANTED!!! RADIO ARTICLES

WE want descriptions of new radio ideas which you have worked out in practice. Take photographs of the important parts and make pencil or pen and ink sketches of the hook-ups or mechanical details, et cetera. We are particularly desirous of obtaining new hook-ups and descriptions of single tube sets, reflex and other types which have proven satisfactory. We like articles on new single tube receptors. We will pay good prices for your ideas. —Editor.

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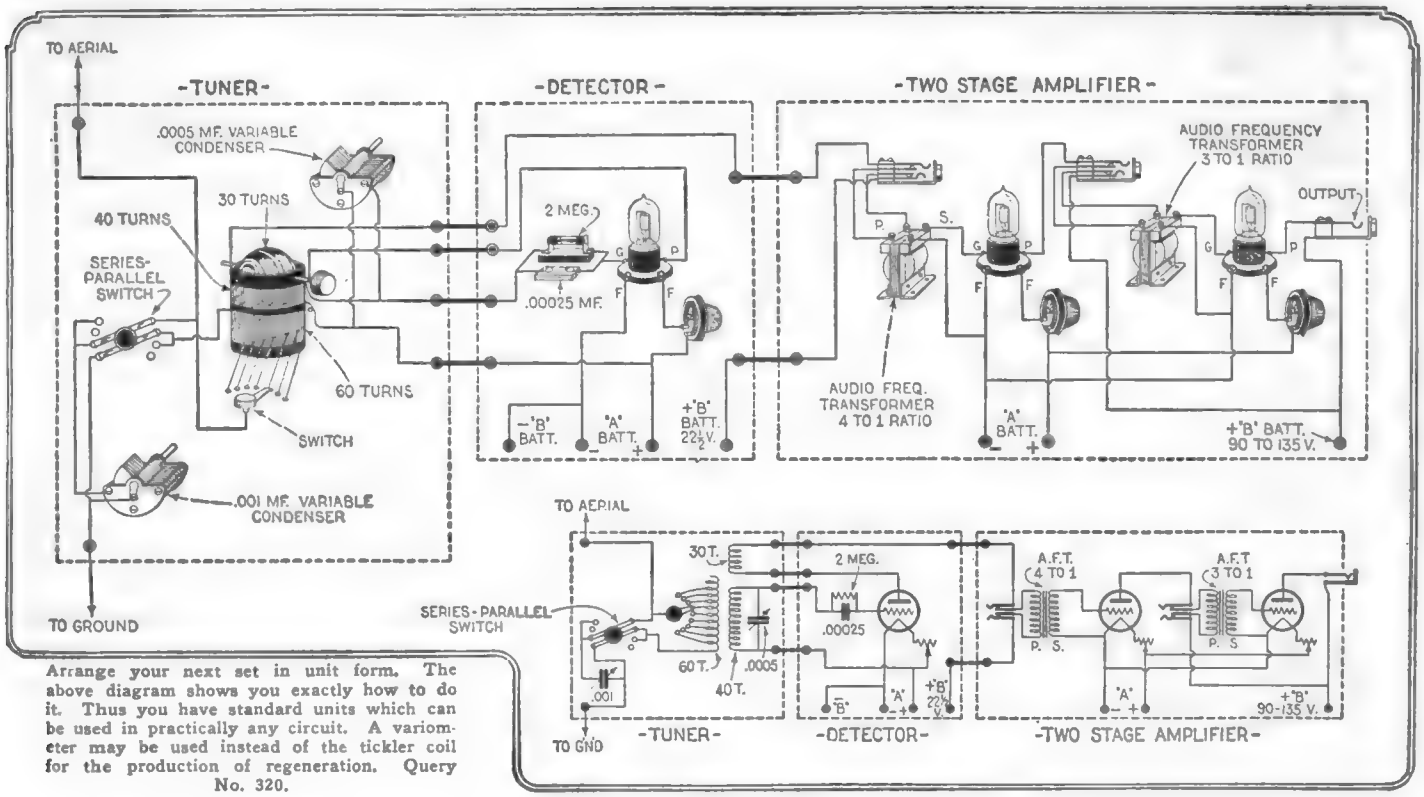


Arrange your next set in unit form. The above diagram shows you exactly how to do it. Thus you have standard units which can be used in practically any circuit. A variometer may be used instead of the tickler coil for the production of regeneration. Query No. 320.

UNIT ARRANGEMENT

(320) Robert Gregor, Philadelphia, Penna., says he is desirous of incorporating his proposed receiver into three cabinets so that they shall contain respectively the tuner, the detector and the two-stage amplifier. He asks:

Q. 1. Can you kindly give me a circuit diagram, together with all other necessary data so that I may be able to construct it?

A. 1. We are pleased to give you herewith the diagram you request. The fact that the different units comprising the set are contained in separate cabinets, allows many different circuits to be employed. Merely by replacing any unit which only requires a few disconnections, practically any circuit can be obtained.

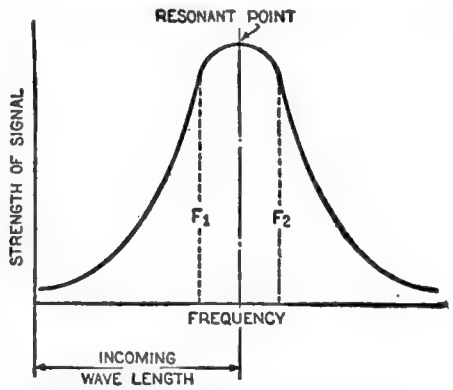
ULTRA-VIOLET RAYS

(321) Dyson Doyle, Brooklyn, New York, asks:

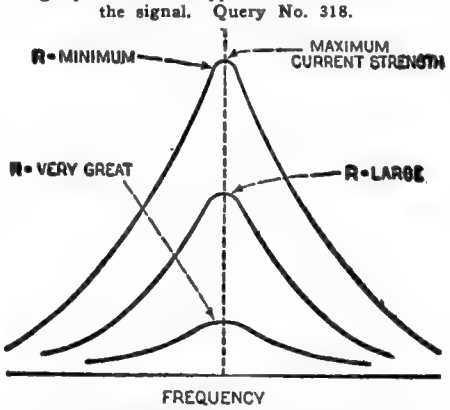
Q. 1. Would be very much obliged to you if you would give me some information on ultra-violet rays.

A. 1. It is of course known that ultra-violet rays are invisible to the naked eye. It is also claimed that light and electricity are closely related, light being of a very high rate of vibration and of very short wave-length. By the phenomena of fluorescence, the wave-length of light is lengthened, whereby ultra-violet rays become visible. In a similar manner, it may also be possible to shorten the wave-length of light to produce electricity. Due to the ionizing properties of ultra-violet rays, Hertz discovered that a spark discharge took place more readily in the presence of violet rays.

A little later, Sella, following Hertz, attempted to use the latter discovery for the transmission of speech and had some success with it. He used a quartz bulb in which were placed two electrodes, one a disk of platinum and the other, a metal ball. It may be interesting to note that ordinary glass is opaque to ultra-violet light. Hence comes the use of quartz glass. There are quite a number of books on the subject of ultra-violet rays and we would be glad to furnish you with the names of the publishers if you so desire.



Note that the greatest signal strength is obtainable when a circuit is in exact resonance with the incoming wave. Detuning your set slightly results in appreciable diminution of the signal. Query No. 318.



Keep the resistance in your circuits low. It means broad tuning and poor selectivity.

LITZ WIRE

(322) John Moore, Staten Island, New York, asks:

Q. 1. Is there any real advantage in the use of Litz wire?

A. 1. It has been the endeavor to increase the electrical efficiency of the receiver by reducing the resistance and other unnecessary losses within the coils and condensers. There are as a result several good types of low loss condensers on the market. However, inductances have long been known that are wound with Litzendraht in place of the solid conductor. The losses by the so-called skin effect which are caused by the irregular or varying distribution of the currents in the conductor are largely reduced by the use of a great number of thin strands of insulated wire. Litz wire is superior to solid conductors only when currents of certain frequencies are flowing through the wires. Therefore, Litz wound coils function much better over a certain predetermined wave-length. For the broadcast range, Litz wire is much superior to the solid conductor. At from 300 to 500 meters its effective resistance is much less. For the very short waves, its efficiency is slightly less and solid conductor wire is to be preferred.

Dr. Lee DeForest's Biography

In the October issue of *Radio News*, there started a biography of Dr. Lee DeForest, inventor of the Audion. This biography will run for 12 months in *Radio News* and we hope all SCIENCE AND INVENTION readers will read this important work by the famous inventor.

INTERESTING ARTICLES TO APPEAR IN THE DECEMBER ISSUE OF RADIO NEWS

The Behavior of Radio Waves and the Heaviside Layer. By Sir Oliver Lodge.
A Radio Controlled Railroad Block System. By Howard S. Pyle.
A New Very Short Wave Oscillator. By Ross Gunn.
A Short Wave Super-Heterodyne. By J. L. Cassell.
The Latest Radio Swindle. By Hugo Gernsback.
The Cold Tube of the Future. By J. H. T. Roberts.
Loop Aerial Circuits. By A. D. Cowper.
Complete List of Broadcast Stations of the U. S.

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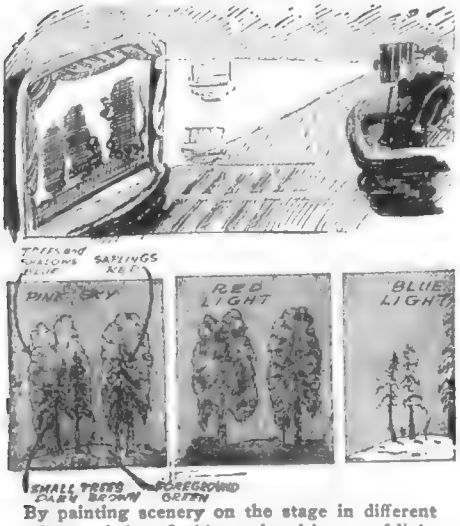
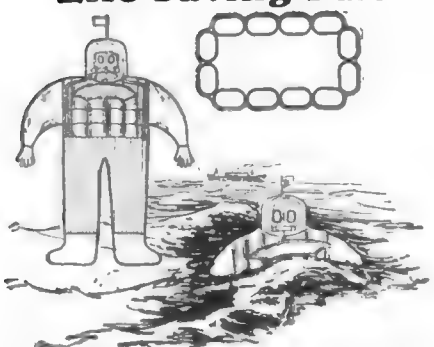
LATEST PATENTS

Scenic Effect



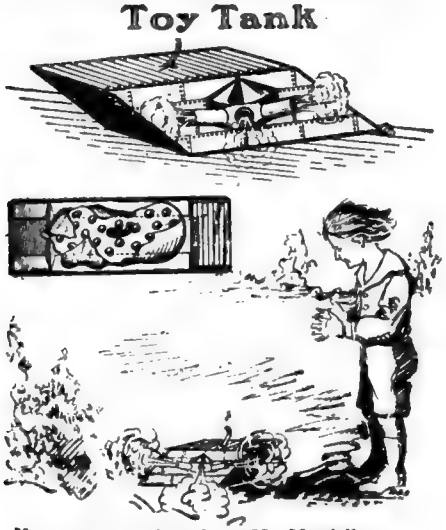
By painting scenery on the stage in different colors and then flashing colored beams of light upon the stage, different effects can be produced resulting in rapid scenic changes. This system was described before in greater detail in this publication.

Life Saving Suit



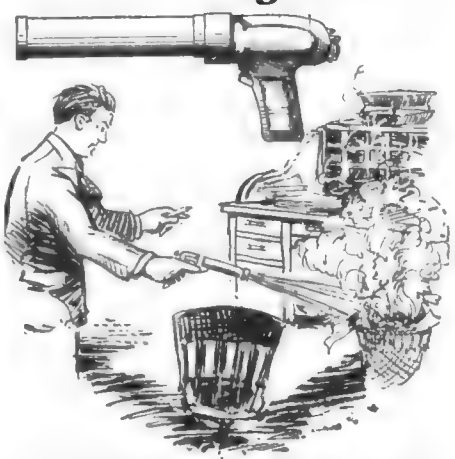
No. 1,500,823, issued to R. J. Kee, describes a suit designed for use on steam ships and other vessels, which suit fully protects and keeps afloat a person who is forced into the water by shipwreck. A view of the suit is shown above. The supporting medium consists of kapok (a vegetable fibre) filled tubes.

Toy Tank



No. 1,503,740, issued to M. M. Adler, pertains to a box shaped as shown containing explosive pellets. These are ignited by means of fuse; puffs of smoke simulate guns.

Fire Extinguisher



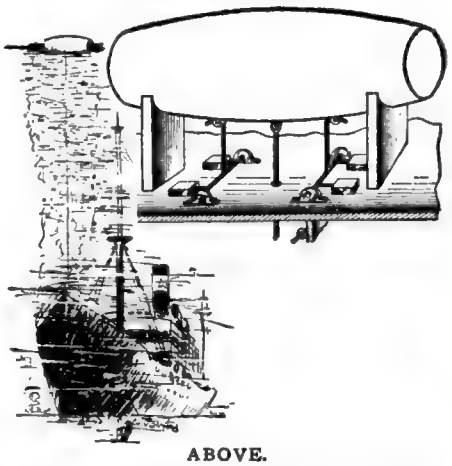
No. 1,500,431, issued to A. Wolf, pertains to a fire extinguishing apparatus constructed in the shape of a gun for easy handling.

WANTED

ARTICLES pertaining to automobiles such as handy kinks, roadside repairs and anything of interest to the man who drives a car. $50.00 in prizes every month are offered by MOTOR CAMPER AND TOURIST for such articles. Get a copy at your newsstand and see what is wanted. If your newsdealer cannot supply you send for free sample copy to:

MOTOR CAMPER & TOURIST
53 Park Place,
New York City.

Sunken Vessel Indicator



ABOVE.

No. 1,596,883, issued to J. Ivory, shows a device for locating the position of sunken vessels. It is mounted on deck and when water reaches it, the large float is released automatically and ascends to the surface carrying a cable.

RIGHT.

No. 1,492,709, issued to C. A. Hall, covers a toy designed as shown in our illustration. The parachute is blown into the air as shown and then floats gracefully to the ground.

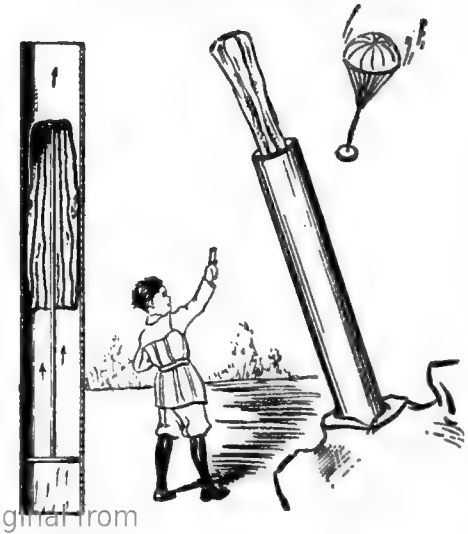
Screw Driver

No. 1,507,990, issued to D. C. Donaldson, covers a screw driver with a flexible shaft that allows the bit to be used in out of the way places. It is illustrated in use above.

Flying Machine

No. 1,506,624, issued to Mr. Forchione, describes the apparatus shown above, which is designed to support a person in the air. Movement of the person's arms is supposed to cause flight while the feet manipulate the guiding planes. We use the word suppose for, as yet, this device has not to our knowledge been put to practical use.

Parachute Toy



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Scientific Humor

JUST LIKE THEM

CRAWFORD: "I see a burglar has been arrested for stealing a lot of radiophones."

CRABSHAW: "The chump! He should have known they would squeal on him."—*Jas. J. O'Connell.*

THIS SCIENTIFIC AGE

A boy is said to be the very photograph of his father, while his sister is heard to be the very phonograph of her mother.—*Harold A. Fidler,* Reporter No. 13691.

WHERE ONE SWALLOW DID NOT MAKE A SUMMER

"Schulz was always lucky."

"Why do you say so?"

"He underwent an operation because he swallowed a pearl in an oyster, and the pearl proved to be valuable enough to cover the cost of the operation—and the funeral."—*James Wade.*

PHEW!

PROFESSOR (to Chemistry Class): "Donald, what is the stable form of ammonia?"

DONALD (waking suddenly from a nap): "Manure."—*O. E. S. Gardiner.*

BY RADIO, PRESUMABLY

On a beach in Toronto, Canada, there is a sign that reads:

"In case of drowning, call life-saving station, Adelaide 3600."—*Lambros D. Callimahos, Reporter No.* 3503.

AND NO WAY OUT

JESS: "Why are joke editors like gas meters?"

GUS: "Well?"

JESS: "Because they weigh out a lot of gas."—*J. C. Mello.*

THIS IS HOT

"Pretty cold weather to use your portable radio set outdoors, isn't it?"

"No; I warm myself by the ampli-fier."—*Les Van Every.*

ONE FOR LUTHER BURBANK

PROFESSOR: "What is a cold storage plant?"

PUPIL: "It's what grows on the meat that is left in the refrigerator, while we are on our vacation."—*R. Hill.*

HOW ABOUT CORN-ED BEEF?

PROF.: "Luther Burbank has proven that corn came from a Mexican weed, and in fourteen years of cultivating this weed he produced corn."

JOHNNIE: "Say! dat's noting, me Ma raised two corns on one toe."—*Arthur Berland.*

PRUNED

FIRST PRUYN: "I'm very happy the Professor used me to test some alcohol last night."

SECOND PRUYN: "Ah! that explains why you are so stewed this morning."—*Paul Smith.*

First Prize $3.00

FEELING HIS WAY

ELECTRICIAN: "Pat, be careful picking up those wires, you're liable to get hooked up with a live one!"

IRISH HELPER: "Niver moind thot boss, oi always feel thim before pickin' thim up."—*Orie Shackelford, Jr.*

A NEW TUNE

JONES: "Yes, I got Cuba last night on my set."

SMITH: "Cuba—that's nothing, I got Japan on mine."

JONES: Japan!"

SMITH: "Yes, but I'm going to scrape it off and varnish it instead."—*Sidney Lang.*

WE receive daily from one to two hundred contributions to this department. Of these only one or two are available. We desire to publish only scientific humor and all contributions should be original if possible. Do not copy jokes from old books or other publications as they have little or no chance here. By scientific humor we mean only such jokes as contain something of a scientific nature. Note our prize winners. Write each joke on a separate sheet and sign your name and address to it. Write only on one side of sheet. We cannot return unaccepted jokes. Please do not enclose return postage.

All jokes published here are paid for at the rate of one dollar each, beside the first prize of three dollars for the best jokes submitted each month. In the event that two people send in the same joke so as to tie for the prize, then the sum of three dollars in cash will be paid to each one.

FOR GOOD CONDUCT

The murderer was awaiting his sentence. He had purposely killed three of his enemies by skillful driving of the street car, of which he was the motorman.

"Judge," he said, "have mercy on me. It was an accident, I assure you. I never was a good motorman anyway."

"Well then," said the judge, "we'll try you out as a *conductor.*"

And he sentenced him to the chair.—*A. Zimmerman,* Reporter No. 11189.

SHOULD BE CHARGED TO HIM

CUSTOMER: "What is the charge for this battery?"

BATTERYMAN: "Five amperes."

CUSTOMER: "Yes, but how much is that in American money?"—*Raymond A. Bailly.*

HE USUALLY TAKES A FIRM STAND, TOO

FIP: "Why does a chemist always have a reply?"

FOP: "Dunno, why?"

FIP: "Because he has plenty of retorts."—*Everett Shepard.*

TERM WELL GROUNDED

"And you term him a Radio fisherman?"

"Yes, he is charged with enthusiasm, is a very broad caster, and he designs hook-ups that will catch anything in the waves."—*Sam Y. Caldwell.*

THE POOR NUT!

"Does he know anything about electricity?"

"No, he even wonders what kind of a nut belongs on a thunderbolt."—*Les Van Every.*

A DIRTY JOKE

PROF. (in Natural History Class): "What animal practises the most rigid economy?"

BRIGHT STUDENT: "The skunk—he makes every scent count."—*Sam Y. Caldwell.*

ANIMAL MAGNETISM

Magnetism was the subject the class of students were discussing, and the Professor asked: "How many natural magnets are there?"

One student excitedly raised his hand and said, "Two, Sir."

"Please name them."

"Blondes and brunettes, Sir."—*Sidney Bamford.*

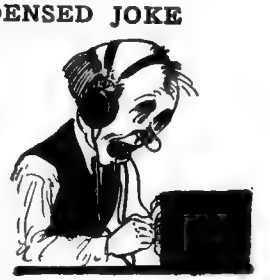
THE LOW DOWN

An Iowa girl, en route to visit friends in New York, entered the city by the Hudson tunnel, then took the subway to the address.

"What do you think of our city?" she was asked on her arrival.

"I couldn't say," she replied, "so far I have only had a worm's-eye view."—*D. W. Pearce.*

A CONDENSED JOKE



1ST RADIO BUG: "Why does Mr. Jones continue to open and close his mouth while he is listening to his radio?"

2ND SAME: "He is making use of his new set of gold teeth as an emergency condenser."—*Paul Saffron,* Reporter No. 4664.

IN THE SHADE

BROKE: "Say Joe you're a broker, can't you give me a tip?"

BROKER: "I know something that is now about twenty and within six months I can guarantee it to go over ninety."

BROKE: "Sounds fine! What is it?"

BROKER: "The Thermometer."—*Louis Ginsburg.*

ONE BAD TURN DESERVES ANOTHER

INMATE: "I think automobiles are a menace to humanity."

KEEPER: "How's that?"

INMATE: "Well automobiles are the cause for tapping 'Old Mother Earth' for oil, and in this manner the earth's axis is deprived of lubrication, which in turn causes it to squeak, thus causing those dreadful earthquakes."—*Paul Penney.*

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THE ORACLE

The "Oracle" is for the sole benefit of all scientific students. Questions will be answered here for the benefit of all but only matter of sufficient interest will be published. Rules under which questions will be answered:

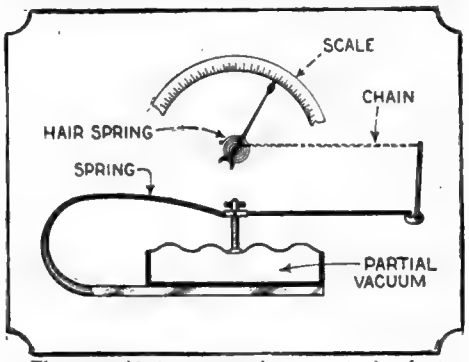
1. Only three questions can be submitted to be answered.
2. Only one side of sheet to be written on; matter must be typewritten or else written in ink, no penciled matter considered.
3. Sketches, diagrams, etc., must be on separate sheets. Questions addressed to this department cannot be answered by mail free of charge.
4. If a quick answer is desired by mail, a nominal charge of 25 cents is made for each question. If the questions entail considerable research work or intricate calculations a special rate will be charged. Correspondents will be informed as to the fee before such questions are answered.

ANEROID BAROMETER

(1775) Jack B. Rust, Verona, N. J., wants to know:

Q. 1. How is atmospheric pressure measured otherwise than by the usual mercurial barometer?

A. 1. The aneroid (from the Greek, meaning without liquid) barometer is an excellent convenient and portable type of barometer that gives very accurate readings in barometric pressure. A disk-shaped metal box is provided with a top made of thin metal, corrugated so as to be extremely flexible. The air within is partially exhausted, as a complete vacuum would cause a collapse of the thin cover. Aside from this, a stout steel spring fastened to its center aids in its support. As the atmospheric pressure increases, the spring yields a little and its point moves downward, acting by means of a lever and a delicate chain to give a greatly increased motion to the pointer which moves over a graduated dial. A small hair spring serves to take up the slack in the chain. With a decrease in atmospheric pressure the reverse takes place and the pointer naturally moves in the opposite direction. It is not quite as accurate as a mercurial barometer, since the elasticity of the spring varies with the temperature, the coefficients of expansion of the various metal parts used and the lag due to friction in the bearings, however sensitive they may be, affect the reading. It must be compared with the mercurial barometer from time to time to get its figure of divergence or error.



The aneroid barometer is one of the best means of ascertaining the correct barometric pressure. Its construction is clearly shown above.

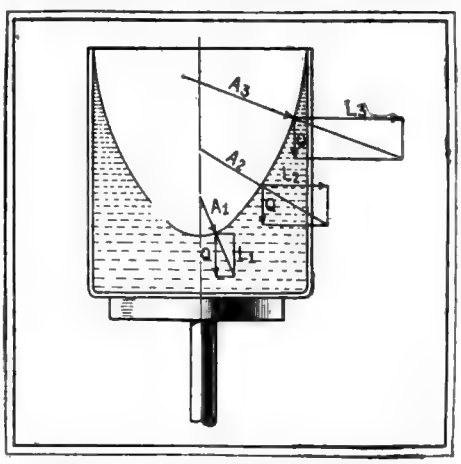
ROTATING LIQUID

(1776) Fred C. Tarr, Gloucester, Mass., asks:

Q. 1. Can you explain why the surface of a rotating liquid is displaced in the center and the exact reasons for this?

A. 1. When a vessel containing a liquid is rotated, the liquid by virtue of its viscosity soon comes to equilibrium and turns at the same rate as the containing vessel. If the speed is slow, the upper surface of the liquid is slightly concave; at greater speeds, it will become deeply hollowed, but it always has the form of a paraboloid of revolution until the speed increases so that it closes in at the top, when a globular vessel is used. A small force, M, due to gravity, exerts against the liquid a downward force MG and an outward centrifugal force which is measured by MW^2R. The downward components Q as noted in the diagram, are due to gravity and are the same at all points on the surface, while the centrifugal components L1, L2 and L3 increase in proportion to the distance of the particle from the axis of rotation. Hence, the resultant force A1, A2 and A3 will be differently inclined and the surface must be of such a curve as to be at right angles to them. As will be noted, the resultant force is greater at points higher up on the surface so that a surface particle near the top presses against the surrounding liquid with much more force than it would if it were at the bottom of the curve. Similarly, the oblate form of the earth is explained. A unit mass at the earth's surface exerts a downward force toward the center of the earth due to attraction and also a centrifugal force due to its rotation. The latter, of course, is zero at the poles and reaches a maximum at the equator, and is always at right angles to the polar axis. The resultant downward force of gravity G, is therefore directed exactly towards the center only at the poles and at the equator.

Surface tension, viscosity, speed of rotation and amount of liquid are variable factors entering into the exact shape which the liquid will assume.



The reason why the surface of a rotating liquid is displaced at the center is graphically shown. A parabaloid of revolution is always formed.

Interesting Articles to Appear In December Issue of "The Experimenter"

How to Make a Crystal Set Loud Speaker.

Making a Radio "B" Battery.

Socket and Switch Testing Machine.

Preserving Magnetic Curves.
By Earle R. Caley, B.Sc.

Electrical Voice Investigation.

The Microphone Relay.

Experimental Short-Wave Receivers.
By A. L. Groves, 3BID.

Superdyning the Reflex.
By R. Washburne.

Experimental Heterodyne.

Filtration and Crystallization.
By J. Edmund Woods.

SIMPLE PARTY TELEPHONE LINES

(1777) Ralph Elden, Jr., Portland, Oregon, requests:

Q. 1. Kindly give me a diagram showing the connections for the simplest four party telephone line that you have available. There must be a bell at each house so that we may call each other.

OUR $12,000 PRIZE CONTEST

IT will be noted from recent issues and the present one that our prize contest has been a whale of a success. Over $1,500 has been paid out this month for worth while contributions to SCIENCE AND INVENTION, either in pictures, suggestions, ideas or articles. We now have on our staff, close to 16,000 correspondent reporters who are scouting the world for new material that can be written up for SCIENCE AND INVENTION. And the formula is simple—just keep your eyes open. Even if you were totally deaf or blind, you could still win a prize by simply using your head and sending us ideas of a scientific nature, or of a nature directly or indirectly attached to new inventions.

ARTICLES FOR JANUARY SCIENCE AND INVENTION

Interesting Stereoscopic Experiments.
Scientific Toys.
The Keeley Motor.
Power From the Earth's Heat.
Animals Which Make Themselves Invisible.
By Dr. Ernest Bade.

Trick Photography with Your Camera.
Metal Etching—How to Do It.
The Digestive System and How It Works.
By Ismar Ginsberg, B.Sc., Chem. Eng.
Interior of a Star.
By Isabel M. Lewis, M. A., of the U. S. Naval Observatory.

New English Tidal Power Scheme.
The Radio Knife—All About It.
By Joseph H. Kraus, Staff Medical Expert.
Experiments in Heat.
By Raymond B. Wailes.
How to Make Rubber Balloons.

FREE INFORMATION

IF you want additional information concerning any of the subjects illustrated and described in this number of SCIENCE AND INVENTION we shall be glad to give you other data we have at our command. To make this work as easy as possible for our editors, please be brief. Write only on one side of the paper and state exactly in a few words just what it is you desire further information on. We have the original manuscripts and drawings of many of these articles in our files and can furnish much additional data in most cases. Please do not fail to send stamped and self-addressed envelope. Make all questions concise and specific.

Address all inquiries of this nature to INFORMATION EDITOR c/o Science and Invention, 53 Park Place, New York City.

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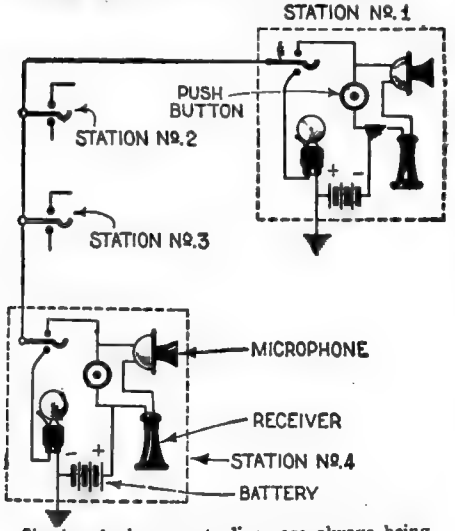
A. 1. Herewith is shown diagram with the very simplest connections for a four party telephone line. Stations two and three need the batteries only for ringing purposes, and they are not to be used for speaking, inasmuch as the opposing polarities of the various batteries will obviously effect the voice with bad results.



Simple telephone party lines are always being constructed. Here is one that can be used by at least four widely separated parties. It will afford considerable service and is simple to construct.

CHEMICAL AND LIGHT TERMS

(1778) Charles L. Thomas, Olyphant, Pa., asks:

Q. 1. Kindly define some of the more important chemical terms?

A. 1. An acid is any substance which yields hydrogen ions.

The Active Mass of a substance is the number of gram-molecular-weight per liter in solution, or in gaseous form.

Adsorption. The ability of a solid to condense gases, liquids, or dissolved substances on their surfaces is called adsorption. It is a manifestation of the force of adhesion.

An Atom is the smallest unit quantity of an element that is capable of entering into chemical combination.

A Base is any substance which yields hydroxyl ions.

A Balanced or Reversible Action is one which can be caused to proceed in either direction by suitable variation in the conditions of temperature, volume, pressure or of the quantities of reacting substances.

A Catalytic Agent is a substance which by its mere presence alters the velocity of a reaction, and may be recovered unaltered in nature or amount at the end of the reaction.

A Colligative Property is a property numerically the same for a group of substances, independent of their chemical nature.

A Constitutive Property is a property which depends on the constitution or structure of the molecule.

A Cryohydrate is the solid which separates when a saturated solution freezes. It contains the solvent and the solute in the same proportions as they were in the saturated solution.

The Combining Weight of an element or radical is its atomic weight divided by its valence.

Eutectic, a term applied to the mixture of two or more substances which has the lowest melting point.

The Hydrogen Equivalent of a substance is the number of replaceable hydrogen atoms in one molecule or the number of atoms of hydrogen with which one molecule could react.

The Heat of Combustion of a substance is the amount of heat evolved by the combustion of 1 gram molecular weight of the substance.

An Ion is a charged atom or group of atoms in solution. Solutions always contain equivalent numbers of positive and negative ions.

A Molecule is the smallest unit quantity of matter which can exist by itself and retain all the properties of the original substance.

A Molar Solution contains 1 gram molecular weight of dissolved substance per liter of solution.

A Normal Solution contains 1 gram weight of dissolved substance divided by the hydrogen equivalent of the substance per liter of solution.

Oxidation is any process which increases the proportion of oxygen in a substance producing other chemical compounds or compound.

Reduction is any process which decreases the proportion of oxygen or other electro positive elements or radical in a compound.

A Salt is any substance which yields ions, other than hydrogen or hydroxyl ions.

The Solubility Product or precipitation value is the product of the concentrations of the ions of a substance in a saturated solution of the substance.

Q. 2. Kindly define the important light terms.

A. 2. Index of Refraction for any substance is the ratio of the velocity of light in a vacuum to its velocity in the substance. It is also the ratio of the sine of the angle of incidence to the sine of the angle of refraction. In general, the index of refraction for any substance varies with the wave-length of the refracted light.

Minimum Deviation.—The deviation or change of direction of light passing through a prism is a minimum when the angle of incidence is equal to the angle of emergence.

Principal Focus of a lens or spherical mirror is the point of convergence of light coming from a source at an infinite distance.

Conjugate Foci.—Under proper conditions of distance and curvature of lens or mirror light divergent from a point on or near the axis of a lens or spherical mirror is focused at another point. The point of convergence and the position of the source are conjugate foci.

Spherical Aberration.—When large surfaces of spherical mirrors or lenses are used, the light divergent from a point source cannot be exactly focused at a point. The phenomenon is known as spherical aberration.

Chromatic Aberration.—Due to the difference in the index of refraction for light of different wave-lengths, light of various wave-lengths from the same source cannot be focused in a point by a simple lens and "rainbow colors" are produced. This is called chromatic aberration, meaning colored aberration.

Achromatic.—A term applied to lenses signifying their more or less complete correction for chromatic aberration.

Magnifying Power.—The ratio of the angle subtended by the image of the object seen through the instrument to the angle subtended by the object when seen by the unaided eye at a distance of 25 cms. (10 ins.).

IMPORTANT

TO NEWSSTAND READERS

IN order to eliminate all waste and unsold copies it has become necessary to supply newsstand dealers only with the actual number of copies for which they have orders. This makes it advisable to place an order with your newsdealer, asking him to reserve a copy for you every month. Otherwise he will not be able to supply your copy. For your convenience, we are appending herewith a blank which we ask you to be good enough to fill in and hand to your newsdealer. He will then be in a position to supply copies to you regularly every month. If you are interested in receiving your copy every month, do not fail to sign this blank. It costs you nothing to do so.

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Resolving Power of a Telescope or Microscope.—This is the minimum separation of two objects at which they appear distinct and separate when viewed through the instument.

Angular Aperture of an objective angle subtended by the object of largest diameter which it can transmit.

Numerical Aperture.—The sine of half the angular aperture, used as a measure of the optical power of the objective.

Dispersion.—The difference between the index of refraction of any substance for any two wavelengths is a measure of the dispersion for these wave-lengths called the coefficient of dispersion.

Diffraction.—If the light source were a point the shadow of any object would have its maximum sharpness; a certain amount of illumination, however, would be found within the geometrical shadow due to the diffraction of the light at the edge of the object.

Polarized Light.—Light which exhibits different properties in different directions at right angles to the line of propagation is said to be polarized. Specific rotation is the power of liquids to rotate the plane of polarization. It is stated in terms of specific rotation or the rotation in degrees per decimeter per unit density.

READING LIGHT

(1779) G. R. Rodgers, Decatur, Ill., asks:

Q. 1. What is the best arrangement of reading lights in order to cause the least amount of strain on the eyes? What color is easiest for the eyes?

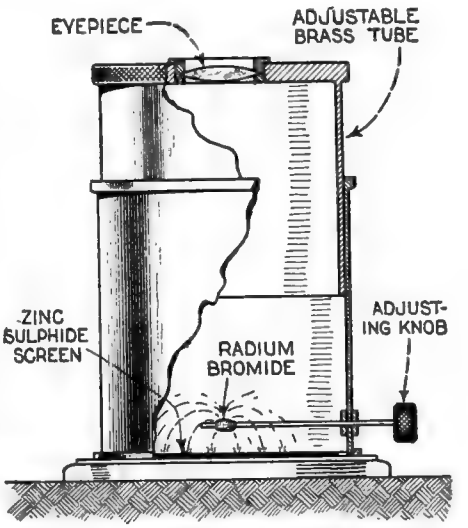
A. 1. The best arrangement of lights for reading is to have a group of several lamps having blue or green filters and allowing the light to come from over the left shoulder with no glare of light on the reading matter. This affords the best arrangement.

THE SPINTHARISCOPE

(1780) Joseph P. Campbell, Trenton, New Jersey, says he has read about radio activity, but fails to find any instrument which will enable him to view emanations resulting from the disintegration of radium ores. He asks:

Q. 1. Can you help me out in this matter?

A. 1. By the use of the spinthariscope, an instrument devised by Professor Crookes, the fluorescent effect of the radiation from radium is beautifully shown. The device comprises a sliding brass tube, having an eye piece at one end and a zinc sulphide screen in its bottom. A small drop of radium bromide is placed on the rod projecting above the sulphide screen. The radiation from this minute quantity of radium compound causes the zinc sulphide to scintillate with constantly changing intermittent flashes of points of light, due to the bombardment of the alpha particles. It is a known fact that the energy of this radiation is great and as radiation seems to proceed from within the substances, the bodies emitting it are affected so as to be kept at a temperature several degrees higher than that of the surrounding atmosphere. In the course of the so-called transmutation which the radio-active substances undergo, an enormous supply of energy is liberated. The spinthariscope is the simplest instrument with which to view this wonderful process of disintegration of radium into lead and helium.



Prof. Crookes' spinthariscope consists of a telescopic arrangement whereby the emanations from radio active materials are made visible. A zinc sulphide screen causes the luminescence, resulting from the bombardment of the alpha particles.

LETTER-HEAD ERADICATOR

(1781) Albert J. McElfresh, Anderson, Indiana, asks:

Q. 1. Kindly show a way or means by which I may remove objectionable printing matter from a letter-head printed in black ink.

A. 1. Printing matter from a letter-head may be eradicated by the following method:

Two solutions are necessary. The first is composed of citric acid, 1 part, concentrated solution of borax, 2 parts, distilled water, 16 parts. Dissolve the acid in the water, add the borax solution and mix thoroughly.

The second consists of chloride of lime, 3 parts, water 16 parts, concentrated solution of borax, 2 parts. The chloride of lime is added to the water and the whole must be shaken well and allowed to stand for a week. The clear liquid should then be decanted and the borax solution added.

In order now to remove the ink from your letter-head, saturate it with solution 1, and apply blotter to take off excess, then apply solution 2 and when the writing ink has disappeared, apply blotter. Then wet with clean water and dry between two blotters. Although this process is rather lengthy, it is a very good one.

DENSITY

(1782) H. N. Stellar, Anglesea, New Jersey, asks:

Q. 1. Why is it that an egg will sink in water and then again sometimes it won't?

A. 1. The reason why an egg will sink in plain water and why it won't in salt water is because salt water has a density greater than that of ordinary plain water. This means that it is harder for the egg to displace the same amount of salt water than of ordinary fresh water. Eggs are sometimes tested in this manner. Old eggs which have a rather large air cavity, readily float while good eggs will drop to the bottom in a diluted solution of salt water.

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We particularly desire to impress upon the reader and prize seeker that a great many of the articles are written by staff writers or are contracted for. Such articles are not paid for from prize award moneys, and consequently the readers' chances for winning a prize are infinitely greater than he may at first believe them to be. To assist readers in securing proper material for publication, we suggest that they carefully read the article on the bottom of this page dealing with the distribution of reporter cards. We further request that those who send articles to the magazine see to it that their name and address appears not only on each page of their contributions, but also on the drawings, and models. We try to avoid losses of names or addresses as much as possible, but this cannot always be done.—*Editor.*

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EVERY month SCIENCE AND INVENTION pays $1,000 or more in gold in prizes. Every text article published will receive a prize—(most of the departments have awards of their own which they give every month). Ideas are what the Editors want. The ideas must be told simply, so that your mother or your sister can understand them—in pictures or sketches or both. But the idea must be new and must have something to do with science or invention.

The Editors want pictures and sketches—must have them—but what they want most is IDEAS. These ideas will be handsomely paid for. We have published a pamphlet showing the rules of the contest which we shall be glad to send to anyone free on receipt of a postal card with your name and address. The pamphlet gives full details, the rules and how to submit articles. The magazine itself shows you what is wanted. Study it closely and submit your ideas.

The closing date for all prize contributions is the 15th of the month preceding date of issue, *i.e.*, the 15th of Dec. for the Feb. issue, the 15th of Jan. for the March issue, etc.

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WILL YOU BE OUR REPORTER?

IN connection with our $12,000 prize contest announced herewith, it goes without saying that you will have to do a little work in order to win a prize. The Editors do not wish to make it hard for you, quite the contrary. We want pictures and ideas and we cannot have too many of them.

Herewith is reproduced our reporter's card. Up to now we have issued over 15,000 of these. Note in our awards how our reporters are winning prizes right along. We shall be glad to send the reporter's card free to anyone who makes an application for it. By means of this card you will be able to secure entry into industrial plants, business houses, motion picture studios, steamships, docks, public buildings, etc. This reporter's card will prove an open sesame to you in many instances. Every card is numbered and only one is given to a correspondent. A postal card from you and a request for this reporter's card is all that is necessary to obtain one. It will be sent to you by return mail. With it we will send you a pamphlet giving rules of the contest and how to proceed in order to get photographs, to send in sketches, and other information in order to obtain a valuable prize. Not only will this card help you to obtain material for this magazine, but it will train you to become a news gatherer, and will be the means of helping you to earn a good deal of money during your spare hours.

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Science and Invention

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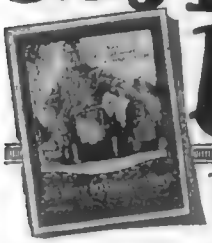

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Doctor Hackensaw's Secrets

By CLEMENT FEZANDIÉ

(*Continued from page 767*)

"Nothing very interesting here," said the doctor. "Probably the heart of a king or some other high personage. I wonder if the resin that formed the stopper may not be more interesting. I have a great mind to examine it to see if by any possibility it might contain some living spore from by-gone days. It will do no harm to try."

And leaving Pep to flirt with the young assistant, the doctor took the piece of amber-like substance into the laboratory and proceeded to cut a small piece from the center and dissolve it slowly in a suitable liquid. For two or three weeks he continued the work, then one day triumphantly called to Pep.

"Eureka!" he cried, "I have found it. I have found a prehistoric microbe—unlike anything that has been found so far. The species must be extinct, but some of the spores became embedded in this resin and have retained their life for three or four thousand years. If you will look at my cultures under the microscope you will see that the species is somewhat triangular, but with the points blunt, making the figure really six-sided. My assistants have succeeded wonderfully and I have now an amount of the culture sufficient to begin my new experiments. I call my new microbe the *'Bacillus Tintageles.'* I named it after 'Miggs' for the reason that with a boy, as with a microbe, you never know what's going to happen. I inoculated some of the germs into a dog, this morning; but unfortunately the dog ran away after the operation. I sincerely hope that if my microbe does produce disease, the disease will not prove a contagious one, or all the dogs of Cairo may fall victims to it."

Unfortunately the disease *was* contagious and contagious to an extraordinary degree. Before a week had passed, there was an outbreak of distemper among the Egyptian dogs. Peculiar eruptions appeared on their bodies, accompanied by a violent fever. Worse still, the plague soon spread to human beings, and men, women and children fell victims to it. Luckily it was not fatal, but it brought them down to death's door, and the convalescence was very slow.

By a miracle Doctor Hackensaw escaped, although he toiled night and day with the new microbe, studying its life history and its effects on man and animals. The epidemic spread far and wide and its ravages resembled those of the plagues of ancient days.

Pep was constantly at the doctor's side, ready to run his errands for him, and to her he unbosomed himself.

"There must exist some remedy for this disease," said he, "and it's my job to find it, since I am the author of the mischief. But I seem to have tried every method known to science for fighting disease, and none seems to answer. Drugs seem powerless. Of course antiseptics such as carbolic acid, bichloride of mercury, etc., will kill the isolated germ, just as they will any other disease germ, but they do not seem able to reach the microbic spores when they are snugly imbedded in the tissues."

"Why not try inoculation?" asked Pep.

"I have. Of course it would be dangerous to inoculate living germs, but scientists have found that the inoculation of dead microbes will often answer. A living germ grows and spreads and so gives the very disease it is desired to avoid. Jenner, with his cow-pox, used a milder germ than that of the small-pox he fought. Pasteur weakened his germs by exposing them to the air. He found that in rabies, which is the scientific name for hydrophobia, if the diseased spinal chords are hung up in the air for a day or two, the germs will become weak and only a mild attack of hydrophobia will result when they are inoculated. By beginning with these weak germs and gradually using stronger and stronger ones, he could make a rabbit or dog immune even to the most virulent germs. In fact he found means of increasing the normal virulence of the germs, for he found that when he passed the disease from one dog to another, the microbe was more virulent in the second dog than in the first one.

"You must know, Pep, that when a microbe attacks a healthy person, the body fights might and main to protect itself. It puts forth all its efforts to localize the disease. Pimples and other such eruptions are prisons which nature has provided for microbes that she has no other means of getting rid of. Then there are the phagocytes or white corpuscles of the blood, which attack the invading microbes and eat them up. The phagocytes are helped by the opsonins which soften the microbes and make them easier to absorb, and also by the agglutinins which glue the microbes into bunches and so hinder their free passage in the blood-vessels. Then there are also the anti-toxins whose business it is to destroy the poisons excreted by the microbes.

"Now microbes are comparatively new to science—practically nothing was known about them before Pasteur's experiments on hydrophobia. But Nature knew about them hundreds of thousands of years ago, and has used her anti-toxines, etc., against them from time immemorial. In fact Nature must know many similar things which we shall not learn of for thousands of years to come.

"From all this you will readily understand that when a microbe enters the body, the alarm is at once given and all the arsenal of anti-bodies attack the intruder. Now it has been found that even a dead microbe introduced into the body, produces these reactions. From which we may safely infer that the action is mechanical or chemical—probably the latter. These dead germs are therefore excellent for inoculation purposes and perfectly safe, for they can cause no disease. But in this new plague they seem of no use. The body has been so long free from this particular species of germ that it no longer reacts to them in the early stages, and the disease therefore spreads through all the tissues unhindered. I have only one last hope left. That is . . ."

The doctor paused. There was a great shouting outside, for a mob of Arabs had gathered in front of the building. They had learned in some way that the doctor was responsible for the present outbreak, and the mob was now stoning the windows and clamoring for vengeance.

"We must get out of this, Pep, at once," cried Doctor Hackensaw. "Quick, borrow your maid's Arab dress and her heaviest veil and I will get an Arab costume from my valet. We've got to get out the back way and get to the hangar. Once in our aeroplane, 'The Hoochie,' we can get to some quiet spot where I can continue my researches. Luckily the Arab dress is ample enough to conceal almost anything. I can carry my flask and test-tubes with me and no one will be any the wiser for it."

"Gee!" cried Pep. "Won't that be great! I'll go barefoot and wear those heavy Arab

(*Continued on page 810*)

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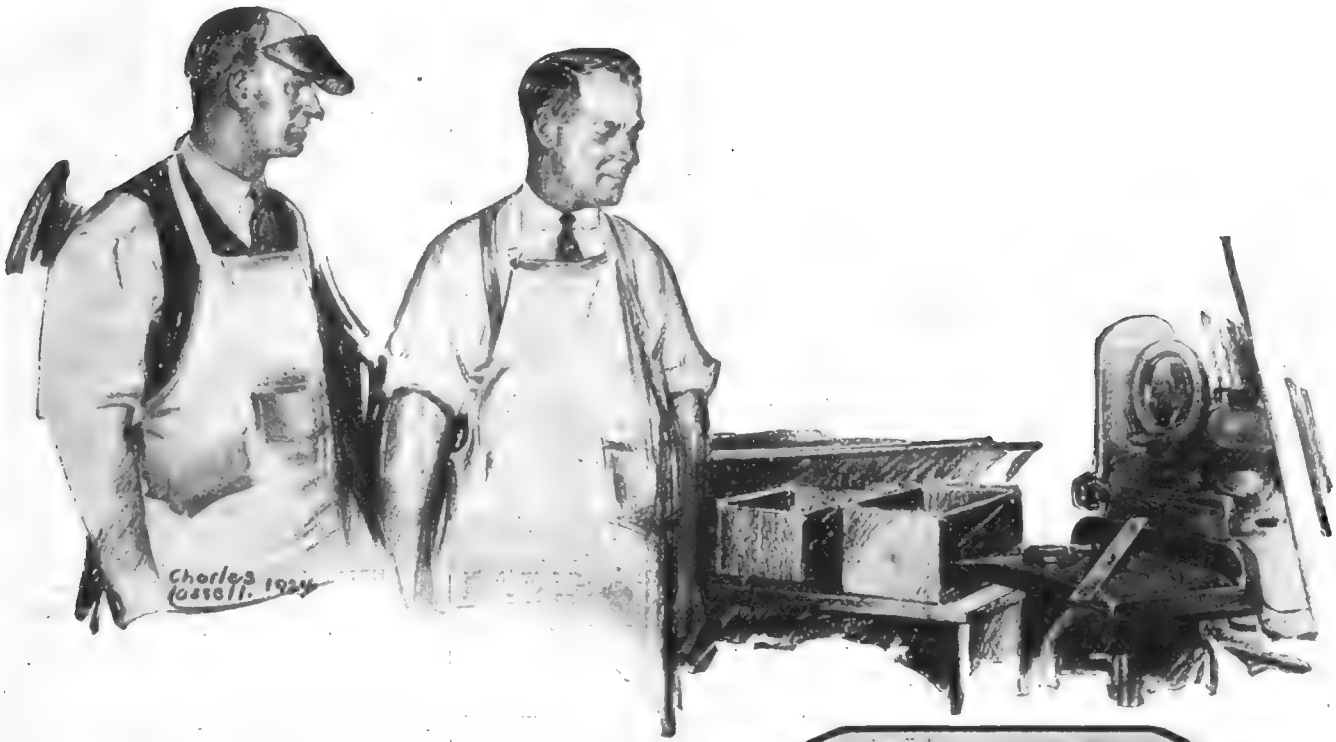

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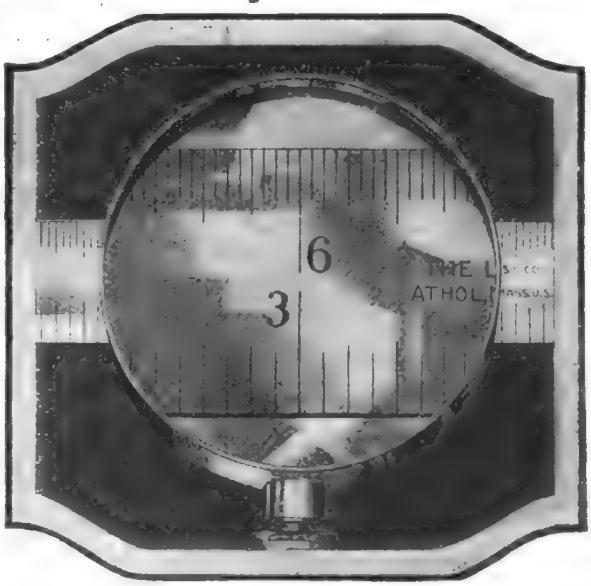

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Doctor Hackensaw's Secrets

(*Continued from page* 808)

anklets I bought. I can easily color my legs brown. This will be the first real fun of the trip!"

Doctor Hackensaw hesitated a moment as to whether to disguise himself as an Arab woman or man. The heavy veil would, of course, be a protection, but to go as a woman would necessitate sacrificing his beard. So he finally decided to go as a man.

"If you carry a basket of green figs on your head, Pep, and I take a water-jug in my hands, I can stop and hide my face by appearing to take a drink if I see any danger of being recognized. Under the figs and in the jug I can pack some of my paraphernalia."

The pair managed to slip out by the back way unnoticed, and once in the street, mingled with the throng, there was little fear of detection. It would have taken a keen observer to detect that they were not real Arabs. They reached the hangar without trouble, and as "The Hoochie" was in readiness for flight, they were soon miles away from the howling mob.

It was not until Malta was reached that the doctor halted. Here he hired rooms and continued his researches with unabated zeal.

For years he had experimented seeking to produce artificial anti-toxines and other anti-bodies chemically, by imitating the natural products found in the human body. All such efforts had so far proved unsuccessful, and there was no time now to prosecute such researches.

"Even a serum is out of the question, Pep," he explained to her one day.

"What's a serum?"

"A serum is what you might call a vaccination made to an animal instead of to yourself. You do not run any of the danger, and yet you profit by the result. The animal is inoculated with the disease and at once begins manufacturing anti-toxines, etc. The anti-bodies appear in the serum of its blood, and by injecting this serum into your body, you profit by it just as though you had manufactured it yourself. The only disadvantage is that the supply does not continue—you have to keep on injecting new serum. On the other hand you run no risks."

"Then why not try to make a serum?"

"I have tried it, but the animals won't re-act to this microbe any more than man does. I have only one hope left. This terrible microbe existed on the earth thousands of years ago, and yet became extinct. What destroyed it? Evidently some enemy—almost certainly some other species of microbe. If so, the probabilities are great that the sealed jar still contains some specimens of the enemy form. I must hunt for them."

This clue was too promising a one to be overlooked, so the doctor began making cultures of every species of microbe he could find in the old jar; and each species in turn he placed with some living specimens of the *Bacillus Tintageles*. And finally he was successful.

"Pep!" he shouted. "I've got it! I've found the antidote to the disease. I've found the microbe that put the *Tintageles* out of existence some thousands of years ago! Victory! I can now undo all the harm I have caused! My! but it was a close shave! It shows again how one man can easily do more harm in the world than a thousand men can repair. Even a scientist, with the best of intentions, may let loose a power for evil. I can sympathize

(*Continued on page* 812)

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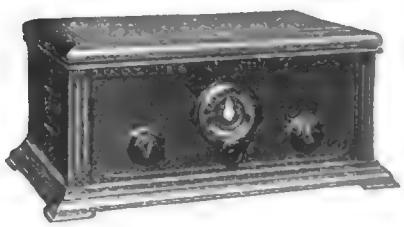

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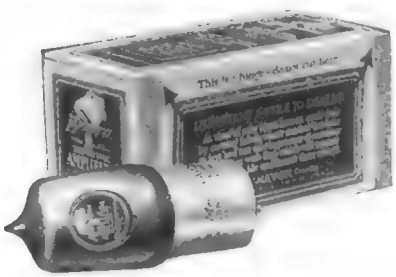

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Dr. Hackensaw's Secrets

(*Continued from page* 810)

now with the old-time monarch,—I think it was Alfred the Great, when he rebuked a chemist who offered him an explosive more powerful than gunpowder; and paid the fellow to keep the discovery secret!"

For the next week or two Doctor Hackensaw was a busy man, for he had to propagate the *"Bacillus Pepita,"* as he called the new microbe, on a gigantic scale. Luckily microbes, like yeast, propagate with tremendous rapidity, and, under favorable conditions, could cover the earth in a few weeks. Large quantities of the new species were shipped to Egypt where their presence at once made itself felt. As if by magic the epidemic was checked, and then those who had suffered from the strange disease began rapidly to recover. The *Bacillus Pepita* had again vanquished the plague as it had once before in prehistoric days.

"Pep, my dear girl," said Doctor Hackensaw, "I can't tell you how pleased I am at the turn things have taken. The experience shows, though, how necessary it is that we should at once begin the thorough classification and study of the different species of microbes. Unfortunately, while our governments find billions for war, they grudge the few millions necessary for such scientific research work. Of course, the study of the bacteria will, curiously enough, lead to the *invention* of new diseases, for doubtless many species of disease germs are harmless today because conditions are not favorable for their spread. Nevertheless we must run the risks, for the microbes are the one dangerous enemy left for mankind to conquer.

"No large animal now in existence, no lion, tiger or other wild beast has any chance of ever supplanting man. But almost any species of microbe, under favorable conditions could multiply in such numbers as to destroy man's food or kill off the last man alive by some dread epidemic worse than any that has ever yet appeared on earth. Our only safety lies in knowledge. An army of militia would be powerless. What we need is an army of competent bacteriologists!"

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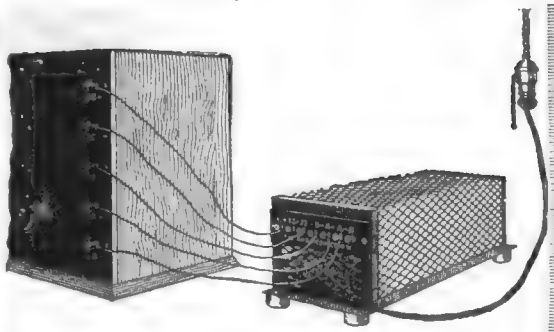

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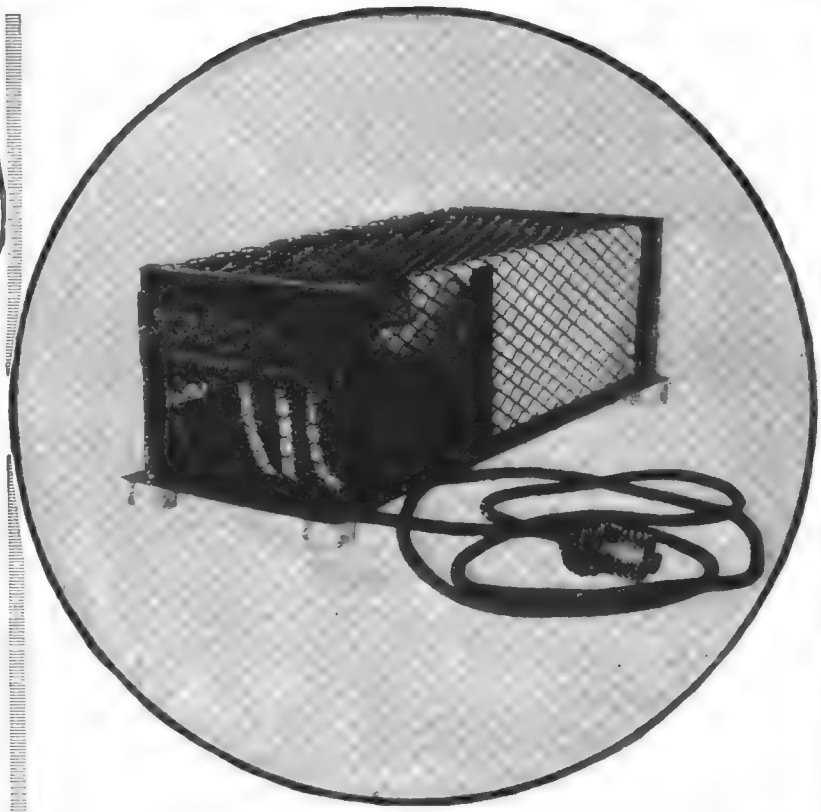

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Entire unit is only 14 inches long by 6 inches wide by 5 inches high. Construction is of the finest materials for dependable long life. The unit is beautifully finished and will not detract from the appearance of the most ornate receiving set.

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Answers to Scientific Problems

(*Continued from page 784*)

THE WEAR ON THE RAILS

THE greater wear that may be observed in the outer rails of a double track system running north and south is due to the earth's rotation on its axis. At the equator the surface of the earth is moving eastward with a velocity of over a thousand miles per hour while near the pole it is scarcely moving at all. Hence a train going north would be passing continually into regions of lower and lower velocity. As a result the eastern or outer rail (if the trains pass on the right) would continually restrain the train's eastward motion as it progressed further and further north, and, consequently it would be this rail that would receive the greatest wear.

For a train passing southward the converse is true. In this case the train passes continually into regions of higher and higher eastward velocity. Hence it would be the western rail that would be forcing the train to take on the higher velocity of the regions into which it was passing and so it would be this—again the outer rail—which would be worn the most.

STEEL BALLS IN A MAGNETIC FIELD

Since they are in a strong magnetic field the balls soon become temporarily magnetized with their upper surfaces all of the same polarity and their lower surfaces of the opposite polarity. On account of their weight they tend to slide toward the center but on account of the mutual repulsions of similar poles they are kept spread apart and forced into positions where the forces acting upon each one is the same in all directions. This situation naturally necessitates a definite arrangement for any given number of balls since in general only one pattern would yield a stable configuration.

THE BULLET AND THE CANDLE

A candle can be shot more readily than a bullet through a board probably because the board offers much less frictional resistance to the passage of the candle than it does to the passage of a bullet. This is especially true since the surface of the candle would be somewhat softened while passing through.

SHORT OF WEIGHTS?

A two and a five ounce weight are sufficient if one desires to weigh out one, or any integral number of ounces of a material. For example, one could place the five ounce weight in one pan and the two ounce weight together with enough material to balance the five ounce weight in the other. Thus one would have three ounces of the material. Then by putting the three ounces by itself on one pan and counterbalancing with the two ounce weight it would be a simple matter to add enough, namely one ounce, of the material to produce an equilibrium in the balance.

TUG O' WAR

The rope would be subjected to twice the tension when the eight boys pulled from one end than it would if they divided up with four on each end.

THE SCALES PROBLEM

When the scales are parallel the load is divided between them and each scale would bear the same load, namely, five pounds.

When the scales are strung together in tandem as shown in the second drawing each scale has to support the entire load, together with the weight of any other scales which are beneath it. Hence the upper scale should read 10¼ lbs. and the lower one 10 lbs.

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No Knowledge of Music Necessary—Sweet Jazzy Tone

You can play this beautiful imported Jazzy Sax without practice. No difficult scales and keys. Play by easy numbers or by ear (or by notes if you wish). Not a toy—*but a real musical instrument!* Made of metal, handsome, glistening, polished finish. Looks like regular saxophone—20 ins. long. Clear ringing tones and delightful harmony. Will make you popular at parties, dances, entertainments—everywhere. No need to spend $50 or more when you can own a Jazzy Sax for a trifle.

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Please send me at once your Jazzy Sax and FREE Carrying Bag and 87 Songs. On arrival I will deposit $5.98 plus postage with the postman. If I am not satisfied, I will return all within 3 days and you will refund my money.

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These are only the important uses of the tool, but many other uses will readily suggest themselves to every radio experimenter. You will wonder how you have gotten along before without the 16 to 1 radio tool. Get one of these happiness tools. You will never again be without it. **D-4800 RASCO 16 in 1 Radio Tool, each $0.35**

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(PATENTS PENDING)

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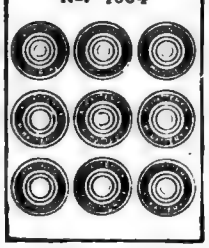
D6900—Crystodyne Zincite Detector with Crystal.....**$1.75**

D6900—Natural Zincite Mounted Crystal especially tested for Crystodyne work, fits any crystal cup **$0.60**

"RASCO" Snap Switch

At last a REAL radio switch constructed for radio purposes, not just a battery switch that may be adapted for radio. The RASCO switch is the only switch with a POSITIVE DOUBLE spring action. No more guess work if the circuit is open or closed. A push of the finger and the current is on. A slight pull and **The Handle Snaps Back** of its own accord. An internal coil spring pushes the handle back when a little pull is applied. This switch is intended as a battery switch to disconnect your "A" batteries. Only one hole to drill. **No tools required** to mount only your finger and thumb. Also this switch takes up a minimum of room, much less than other switches, the base of the switch measuring only 1¼x1½" All metal parts nickel plated. A switch you will be proud to possess. **D4850-RASCO** Snap Switch. **Each 25c**

"RASCO" NAME PLATE ASSORTMENT Nº. 4994



This Name Plate Assortment Packet contains Nine Binding Post Name Plates as follows: one Aerial; one Ground; two Phones; one "A" Bat. —; one "B" Bat. +; one "A" Bat. +; one "B" Bat. —; one "C" Bat. +; one "C" Bat. —.

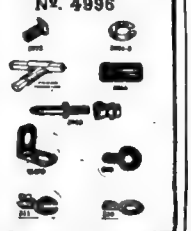
D4994 Nine Name Plate Assortment **$0.20**

"RASCO" LUG ASSORTMENT 50 LUGS 5 DIFFERENT STYLES Nº. 4995

This Lug Assortment Packet contains fifty of the most important lugs for the man who "Builds His Own" as follows: 10 lugs for 8/32; 10 for 6/32; 10 prong lugs (solderless) 6/32; 10 ditto 8/32; 10 flat type 6/32. All lugs are tinned.

D4995 Lug Assortment **$0.22**

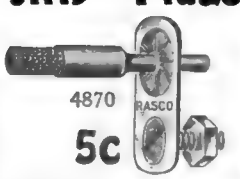
"RASCO" RADIO NEEDS ASSORTMENT 108 PIECES Nº. 4996

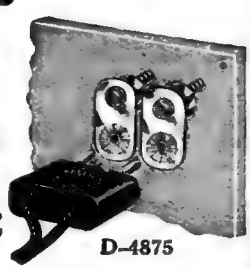


This assortment contains 108 pieces as follows: 36 "T" Wire Bus-Bar Connectors; 4 Adapter Bushings (to fit ¼" dial to 3/16" shaft); 4 Separable Phone Tips; 4 Angle Brackets; 24 Lock Washers; 36 Assorted Lugs, already tinned for easy soldering.

D4996 "RADIO NEEDS" Assortment **$0.48**

"RASCO" "Jiffy" Jacks and "Jiffy" Plugs





Again, **Rasco leads with a** small but important radio novelty. **JIFFY JACKS** are the simplest, and most efficient Cord Tip Jacks ever designed. Stamped from a single piece of metal they grip any style cord tip from any make phone or loud speaker. The JIFFY JACKS take but a minimum of room. All you need do is to drill two small holes in your panel and mount the JIFFY JACK with screw and nut furnished. **No soldering necessary** as the wire goes right on the screw. X-ray view shows how two of the jacks are used in conjunction with our **Jiffy cord plug.** The jacks go on in back of panel, only screws show in front. JIFFY JACKS take practically no room when mounted and are made of best spring brass that will not wear out. Hundreds of other uses for our JIFFY JACKS. **We will pay $1.00 for every new use for JIFFY JACKS that is accepted by us.**

JIFFY PLUGS are made of semi-hard rubber into which the tips of your phones or loud speaker are pushed. The cheapest and simplest plug ever designed. Its small size and neatness made it famous over-night. Size 1 in. long, ½ in. wide and ⅝ in. thick. No tools required. Just wet the metal cord tips and push through openings. Plug can be used with any standard cord tip jack, but best with RASCO JIFFY JACK.

D4875-Two Jiffy Jacks with nuts and screws and one **Jiffy Cord Plug**.....**$0.20**
D4870-One Jiffy Jack complete with nut and screw **0.05**
D4871-Jiffy Jacks without nuts or screws, two for **0.05**
D4880-Rasco Jiffy Plugs, each..... **0.10**

"RASCO" Clip Leads

Here is something that every experimenter has been waiting for impatiently. This is a flexible silk-covered conductor to the ends of which are **soldered** strong brass spring clips. Instead of using wires to make your connections—screwing and unscrewing binding posts

—a clip lead hooks in a jiffy onto any wire, any binding post or other conductor in order to make a safe experimental connection. "RASCO" CLIP LEADS come in two colors, green and red, to distinguish connections. Brass clips have powerful grip. Length of clip lead, one foot.

D7887 RASCO CLIP LEADS. Each...**$0.12**
Dozen lots **1.35**

"RASCO" Brackets

Here is a line of small brackets evolved especially for the man who "Builds His Own." They can be used in a number of different ways—to hold tuning coil tubes; inductances; spider webs, etc.; to hold up pancls; to attach various instruments to baseboards, etc. "Rasco" brass brackets are stamped from heavy metal and have been designed to do the work right. They are nickel-plated and carefully finished.

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D1475 Brass Angle Piece, 5/16" wide x 7/16" high. Each.....$0.03
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D1505 Brass Angle Piece, size 1½" high x ⅝" long..... .05
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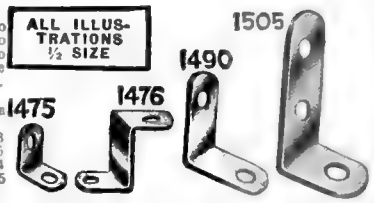

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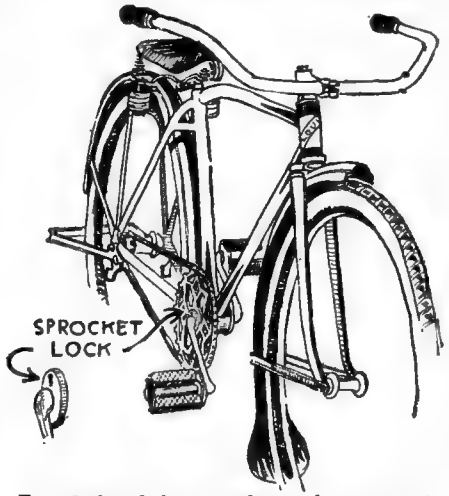
BICYCLE LOCK

(847) Edward DeVoe, Berwick, Pa., has designed a hanger lock for bicycles. He would like a resumé of the situation concerning such locks and our advice as to what to do with his idea.

A. 1. While your suggested lock for a bicycle would undoubtedly work quite satisfactory, still there are many deficiencies in it.

In the first place, it would by no means prevent the theft of the wheel. A bicycle chain can



Even locks of the type shown above are not absolute protection against theft.

readily be removed without tools, whereupon the bicycle could be pushed away with the greatest of ease. The best type of locks which give fairly good protection are those padlocks with the long hasps which are designed to lock the back wheel to the fork. Thus the wheel cannot be moved unless the thief has a pair of powerful cutters. We do not believe that your lock has sufficient novelty or that bicycle manufacturers would look upon the same with favor.

OLD IDEA

(848) E. B. Dodson, Memphis, Tenn., suggests an extremely old idea and asks our opinion as to a patent attempt upon it.

A. 1. The idea which you have suggested on sounding a horn when the automobile leaves the garage so that pedestrians will be warned is very old.

We would not suggest that you apply for a patent on the idea as many similar systems are being used in New York at the present time.

ANOTHER MOUSE TRAP

(849) G. M. Depew, Summershade, Ky., submits a novel but complicated mouse trap design and asks our opinion as to its salability.

A. 1. In the first place, your proposed mouse trap is rather complicated and of course this is a great drawback to its being manufactured cheaply and to its use after being sold. There are several mouse traps which have been described in various magazines which operate on much the same principle as yours with the exception that they are much simpler and act practically instantaneously. We believe that they are of much greater advantage and much better than yours. Obviously, we would not suggest applying for a patent on your device.

AIRPLANE SUGGESTION

(850) D. J. Davis, Seymour, Conn., has an idea concerning airplane construction. He submits it to us for our approval and asks our opinion concerning patent and construction.

A. 1. We would not suggest that you apply for a patent on any type of airplane.

The construction of such a device is very expensive and it is quite impossible to obtain the finances for a demonstration of the completed device.

We do not know of any individual or concern willing to undertake the work.

POWER STACK

(851) S. Boatman, Carlinville, Ill., has devised a method for obtaining power from a stack draught. He wishes our criticism of the idea.

A. 1. There is no doubt but that a draught will take place in the stack, but the extent of this draught will vary, depending upon atmosphperic conditions and also upon the temperature of the outside of the stack due to the sun's rays, or due to the heat at the bottom of the chimney. Consequently conditions will constantly change, and days will be found when there is absolutely no draught running through the stack.

We doubt very much that your system will work, but it will not cost a fortune to build it. Undoubtedly you will find some friend who will be glad to let you use a factory stack in order to install your device. We would suggest that you give it a thorough trial. The writer cannot, however, change his opinion and still maintains that he does not believe the system to be practical. It smacks of perpetual motion and so far in spite of promised machines which were to be sent to us, no one has collected the $1,000.00 offered by us for a glimpse of a perpetual motion machine, although many have claimed to have invented one.

TIDAL POWER PLANT

(852) James H. Blackaller, Pearsall, Texas, submits the plans for a tidal power plant and asks our advice.

A. 1. The cost of constructing a tidal power plant such as you have designed would be so great, and its efficiency so low, that nothing could be gained by its construction.

The suggestion is not new by any means and the project itself would not possibly be constructed by any organization in the United States. We certainly would not suggest that you apply for a patent on this idea.

(*Continued on page* 818)

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The Heavens In December

By ISABEL M. LEWIS, M.A.

(*Continued from page 783*)

variable star and probably a worthy rival of the great Betelgeuse.

One of the most interesting constellations now visible in the east is Taurus, The Bull, which is easily located by means of its two conspicuous clusters, the Pleiades and Hyades, with which everyone should be familiar, for they are two of the most noted groups of stars in the heavens. Like Pegasus, The Winged Horse, only the head and forequarters of the animal are represented on the star atlases for according to one legend this is the snow white bull in disguise, of Jupiter or Zeno, which is swimming through the sea toward the island of Crete bearing the maiden Europa on his back. According to another legend he is charging down upon the warrior Orion, who is now rising in the east and threatening him with uplifted club. The V of the Hyades represents the forehead of the bull and Aldebaran is his blazing red eye. The tips of the long horns are marked by two stars, of the second and third magnitude respectively, south of Auriga and northeast of Orion. On the southern branch of the V is the interesting double star, Theta, which is visible as a double even to the naked eye.

The Hyades and Pleiades are both moving clusters of stars in a region abounding in vast nebulas, both dark and luminous. Though the unaided eye sees in the Pleiades only six or seven stars, an opera glass will show over two score, and a three inch telescope fully one hundred, and there are known to be at least two hundred and fifty stars belonging to the Pleiades group and all drifting through space together. Photographs taken with powerful telescopes show nebulosity enveloping all the brighter stars in the cluster, which nebulosity shines by reflected light of the stars involved. The distance of the Pleiades is estimated to be about three hundred light years, that is the light of these stars traveling at the rate of 186,000 miles per second takes about three centuries to reach the earth. The Hyades are much nearer to us than the Pleiades, the distance of the group being estimated at about one hundred and forty light years. Here are extensive dark nebulous regions that are projected against a background of stars as dark clouds or streaks, into which possibly in the course of the ages our own solar system may penetrate.

Two huge constellations now filling the greater part of the southern heavens are Cetus, The Whale, stretching its enormous bulk across the meridian due south, and Eridanus, or as it is sometimes called, Fluvius Eridanus, The River Eridanus, appearing in the southeast. There are no first or second magnitude stars visible in our latitudes in this constellation though it contains one star of first magnitude, Achernar, which is in the southern hemisphere far below our horizon. There are many stars of fourth magnitude, however, and a few of the third in this long winding constellation, and we can easily trace the course of this River of The Sky toward the west and southwest from a point near Rigel in Orion to the southern horizon whence it continues its course far into the southern hemisphere.

Cetus, which represents the sea monster sent to devour the maiden Andromeda chained to the rocks, a sacrifice for the vanity of her queen mother Cassiopeia, contains but two objects worthy of notice, one the

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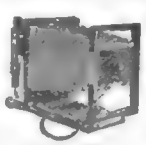

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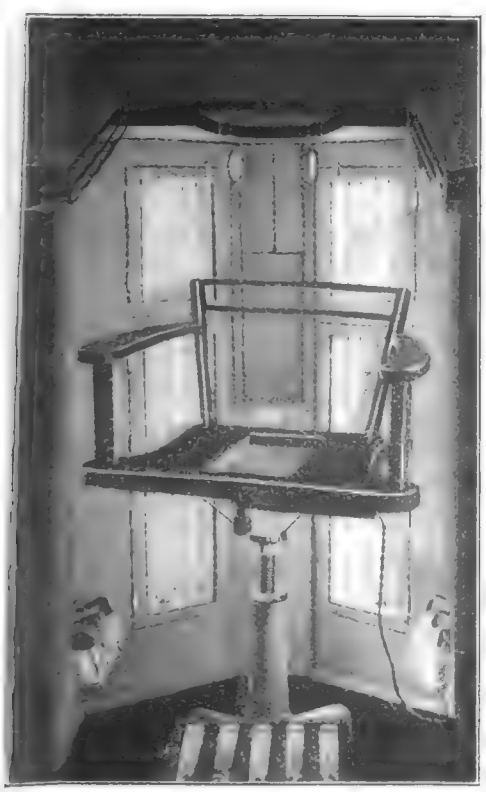
second magnitude star, Diphda, brightest star in the constellation standing in solitary splendor over in the southwest, and the other Omicron Ceti, popularly known as Mira, The Wonderful, the first known variable star.

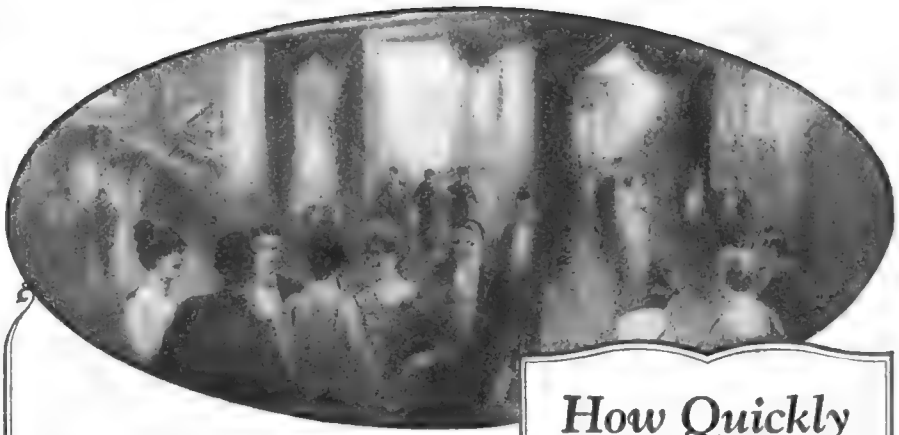
The variability of Mira was discovered in 1596 by Fabricius and the star has been observed through more than three hundred of its irregular cycles of light change which average about eleven months in length. Usually the star is far below visibility to the naked eye but after a slow but gradually accelerated increase in brightness it flashes into visibility for a month or more and at its best is a star of the second or third magnitude. Then follows a gradual decline to minimum brightness at which it is usually of the ninth or ten magnitude. Another interesting chapter in the history of this remarkable star was written a year ago when Dr. R. G. Aitken, associate director of the Lick Observatory, found that it was attended by a close companion star. The companion is bluish in color and half a magnitude fainter than Mira, which like all long period variables is reddish in color. Careful examination of this star twenty years or so ago by Dr. Aitken and others failed to reveal the presence of its companion star, which was probably too near the brighter star to be seen at that time. The distance of Mira from the earth is placed at about eighty light years and at minimum brightness it is much inferior to the sun in luminosity though there is a range of over ten thousand fold between maximum and minimum brightness of this star. Needless to say Mira has no inhabited planets encircling it!

Mars alone of all the planets is now visible at the time for which the chart is given and will be found over in the southwest. Its brightness has decreased rapidly since August and by the end of the month it will be inferior in brightness to Capella and Rigel but still half a magnitude or so brighter than Pollux and Aldebaran.

Electric Bath



Electric bath cabinet on board Steamship "Deutschland."



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on in the direction of that mirror-like sheet of water we had seen nestling in the midst of the hills.

"'Be careful!' I admonished after them.

"Thompson raised the rifle and with a smile tapped it significantly. The next moment he and the two others had vanished from sight—never to be seen by us again. What we did see—the horror of that who could ever forget?

"We journeyed on, Hampden and I, steadily and with no little caution, now and again stopping to examine some strange plant or tree or flower. A strange, weird stillness and silence lay upon everything. At times leaves would move in a current of air, but there seemed to be something ghostly about those movements and the low rustling that accompanied them. It was as though they gave token of the presence of spirit things there in the air about us—things stealing about and following us with some sinister purpose. It was as if, in some mysterious way, warnings of some terrible impending danger and mystery were being borne to the senses.

"I fought against this uncanny, unaccountable feeling, but I could not conquer it. Instead, it seemed to get its hold all the tighter upon me gripping, as it were, with the tentacles of an octopus. I called myself a crazy femmelette, an unmitigated fool and cursed myself for an idiot in good whacking fashion; but it all was of no use. That horrible sense of something impending, something *watching* and yet unseen—that horror had me, and I could not shake it off.

"Yet, though I was thus so mysteriously and powerfully affected—and, as I have said, I truly believe that I am by no means a nervous man—I did my utmost to prevent any sign of what I felt being seen by Hampden. Whether I succeeded in this or not, I can not say. But I do know that Hampden too was in the grip of that viewless, but none the less terrible, thing that I have likened to an octopus.

"But there was not a moment's hesitation. We talked and acted (at any rate, we tried to) as though we were having the gayest time in the world—all this, however, without any effect upon our caution and watchfulness.

"'All the same,' said I to myself, 'you ought to be ashamed of yourself. Like a kid—a big, an overgrown kid afraid of the dark!'

"The next instant Hampden came to a surren stop, his hand closing on my arm and gripping it like a vise.

"'Listen!' he exclaimed in a whisper.

"We listened, but all I could hear was a ghostly rustle of leaves and the mournful drone of insects.

"'What was it?' I asked at last—my own voice too a whisper.

"'I don't know.'

"'A shot from Thompson's rifle, most likely.'

"'No!' Hampden declared. 'Whatever it was, if it was anything—whatever it was, it wasn't that!'

"We listened for a time.

"Then I queried:

"'If it was anything?"

"'Yes,' returned Hampden: 'if it was anything. For I'm not sure that the sound was a real one. My brain might have tricked me. But, whether real or imaginary, that sound I heard or thought that I did—well, whatever it was, it wasn't the report of a rifle.'

"I smiled a little at this but without letting Hampden know it. I thought his nerves were getting on the jumps. Certainly I had heard nothing whatever myself. But I did not smile afterwards when I thought of this incident.

"Did Hampden really hear something, or was it only a trick of his senses? We never

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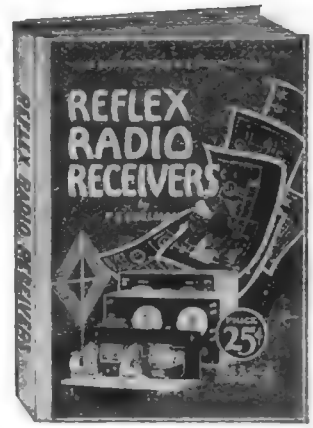

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learned, and now we never shall. I have my belief, however, and that is that the sound was a real one—that at that very moment the horrible tragedy had begun.

"Let me hasten on to the awful end, for I shudder to think of it, let alone to tell it.

"Hampden and I went on for perhaps a half hour longer. Evidently the lake was farther away than we had thought it. Also, we had to acknowledge that we were not sure just where we were. I don't mean by this that we were lost, that we would have any trouble in retracing our steps. What I mean is that we were no longer certain of the lake's precise direction. So we would go back and explore the Gardens of Paradise at some more opportune time.

"At length we stood again in that spot where our companions had left us. This was a long hill or ridge. Up this ridge we proceeded and in a few minutes had stepped out into the large open space above. We were perhaps two-thirds of the way across this spot—only a few stunted shrubs grew there—when Hampden stopped as though struck by a bullet and gave the strangest, most horrible cry that I had ever heard in all my life.

"The next moment I saw it. I don't know whether I cried out, too, or not, but I do know that I turned very sick at the sight.

"There, not fifty feet from the spot where we stood, lay a head—a severed human head!"

CHAPTER X
BY A GREAT CLAW

The explorer leaned forward in his chair. I saw a shudder pass through him. He covered his eyes with his hand.

I turned my look to Darwin Frontenac. His eyes were fixed on Captain Livingstone, and they shone with a light that was almost a glitter, whilst the expression on his lean features was so eager and keen that, I experienced something like a sudden shock.

"And," he said after waiting some moments for the other to go on, "you saw there a severed human head?"

"Yes; that is what we saw."

Again Captain Livingstone lapsed into silence.

Darwin Frontenac queried:

"Was that *all*? Was there nothing else—no body there?"

"None. We looked all around, but there was no sign of the body anywhere. There was nothing but the head and a great quantity of gore, as though the body had been completely drained of its blood."

"Strange!" Frontenac muttered.

"We went to it and saw—how horrible it is to see the picture again!—that the head was Wilkie's."

"One moment, Captain Livingstone," said Frontenac. "How had the head been severed?"

The captain looked at him inquiringly.

"I mean," said Frontenac, "had it been cut from the trunk, or had it—?"

"Cut. How else could it have been done?"

"With a sharp instrument or—?"

"I don't know," Captain Livingstone said, "that any *instrument*, any *weapon* had been used to cut it off. Such a thing might have been used, but it is my idea that it was probably something very different."

"You interest me exceedingly, Captain Livingstone! What, then, is your explanation?"

The explorer gave a significant gesture.

"I have no explanation," he said.

"You interest me more than ever, Captain Livingstone!"

Frontenac looked at the other keenly, searchingly for a few moments, then said:

"Was the cut a clean one, or was the flesh torn and jagged?"

"Torn and jagged—horribly so. And across one cheek were marks that seemed to have been made by a great claw."

"Claw?" Darwin Frontenac exclaimed.

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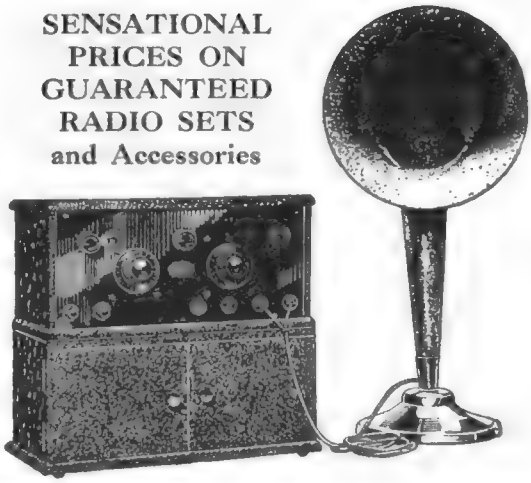

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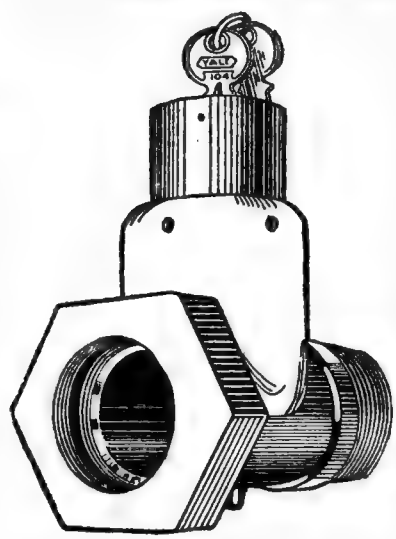

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He sprang out of his chair and began to walk back and forth before us, his manner somewhat abstracted,

"You are sure, Captain," said he stopping, "that it wasn't a *hand*?"

"A hand! Great God, no! I tell you, it was the mark of an enormous *claw!*"

CHAPTER XI

SLEEPING BEAUTY

For some moments Darwin Frontenac stood like one plunged in profound thought.

"Very strange!" he muttered at last, not aware, evidently, that he was speaking aloud. "A claw. An enormous claw. Now, I wonder if it were possible that—"

For a little space longer he stood there, then suddenly came out of his abstraction; he returned straightway to his chair and seated himself once more.

"Captain Livingstone," said he, "I never heard or read a stranger story than this you have told.

"The body, you say, was nowhere to be found?"

"No; it was gone."

"Any sign of a struggle?"

"None whatever. There were a few marks on the hard ground, but they were faint, and we could make nothing of them."

"Was there no sign to show in what direction the thing had carried the body away?"

"We could see none. The thought may seem a fantastic one, but how can we be sure that the *thing* moved on the ground?"

Darwin Frontenac leaned forward.

"Then," he suggested, "you think it possible that—"

"I do not offer any explanation, Mr. Frontenac. It all is an utter mystery to me.

"I told you," he went on, "that there was nothing but the body there. We thought so, but at last I found this, some thirty or forty feet from poor Wilkie's head."

He drew another paper from his pocket-book. It was a sheet from a note-book, and one edge of it was very ragged, as though it had been torn out in great haste, and the whole badly soiled. This he handed to Frontenac, who read it a second time and yet a third and then, without any comment, reached it over to me, the dark contraction of his brows, however, speaking more plainly than his lips could have done.

This is what I read, some of it so hastily written that it was barely legible:

"Go. Don't risk a single hour here—a single minute. Would need more men—many rifles. We had no show. There was no warning. Don't know, but it seemed to drop on us. Killed Thompson and Bogardus instantly. No chance to use rifle. I was badly wounded but got away. As I crawled saw it taking their heads clean off. Badly hurt—don't think can go farther—escape. Fear am followed. (The words that succeeded seemed to have been written in frenzied haste.) Think I see—God have mercy—it's coming now."

What, in God's name, was coming then—when he wrote those last words, even as his doom was upon him?

There was a deep silence in the room. It would be difficult to say how powerfully I was affected by this hasty, meager scrawl. And yet, after all, it was not so much what it told—it was what it didn't tell—it was what the poor doomed man would have told but could not.

One saw him there, alone, sorely wounded, overshadowed by a death horrible beyond all words, and yet, in those last awful moments, trying to leave a warning to the others—a warning to his kind and companions.

I thought I saw in this poor Wilkie a personification of that type, that brave man and true, that is the ideal of the race. So long as it has such sons, whatever its failings

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and sins and madness, all will be right in the end. When that noble (at times terrible) breed dies out, Heaven pity us all, for we shall sorely need it then.

I read Wilkie's message again and yet again, then reached it to Frontenac, who had extended a hand for it.

Once more he read it, then gave it back to the captain.

"I wonder," Frontenac said, "why it was torn out."

"I have often wondered at that myself, Mr. Frontenac."

"Did you find the book?"

"No; all we found was the pencil he had used.

"We were in a dilemma now. What was to be done? Go see if we could find Thompson and Bogardus, said I. To this Hampden was opposed, and I had to acknowledge that he could put forth the best of the argument.

"'It would be a foolish risk, Captain Livingstone,' he said. 'And for nothing. If we could hope to help them, it would be altogether different. But we can't. They're beyond that now. Look at what Wilkie says:

"'As I crawled saw it taking their heads clean off.'

"'What you say,' I told him, 'is true, but no one can say that I was afraid to go and recover the body of a comrade and friend.'

"'Very well,' said Hampden at last, 'if you are bound to go down there, I'll go, too. I can't see you go alone. But I tell you this: I think the chances are that we shall never come back, and so this wonderful discovery of yours will be lost to the world.'

"'I know that. Yet I am going.'

"'Then so am I,' Hampden said. 'I think this is what we ought to do first, though: go up to the sleds and get an ax. Not the best weapon in the world, but it is all there is, and I may be able to do something with an ax. Not much though, I fancy, seeing that Thompson never got a chance to fire a single shot and that the others couldn't get a hand on the rifle. Remember, Captain, what Wilkie says:

"'*It seemed to drop on us.*'

"I remembered that. There wasn't a single word on that horrible paper that I didn't remember—that wasn't seared on my brain. But all I said was:

"'Let's get that ax.'

"So we started up, Hampden carrying Wilkie's head. The hair on it was rather long, and so he carried it by the hair—a horrible sight to see."

"One thing, Captain Livingstone," said Frontenac: "could the dogs be seen from that open spot where you had come upon Wilkie's head?"

"Oh, no. We had left them in a little hollow; you couldn't see them until you were right close."

"Did they bark or howl, make any sound that might have attracted attention to them?"

"None that we heard."

"I see," said Frontenac.

"Well," the captain went on, "Hampden got the ax (and a knife) and we started down again. We knew, of course, the direction that the three had taken on parting, but they had left no trail to guide us. We had but little difficulty, however, in finding the place of the tragedy, for Wilkie had *crawled*, all the way out, and the signs he had left were not hard to follow.

"Yes, there at last we stood, Hampden and I, in that place where the horror had dropped down upon them.

"There were palm-trees all about, but the spot itself was beneath the branches of a great cypress. The thing easily could have lain hidden up there, and we had no doubt whatever that it was from one of those branches that it had dropped. But what was it? There was nothing to throw any light on that. There were marks of a struggle, but it was plain that that struggle

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had been a very brief one. And what we had found in that spot where poor Wilkie had been killed, that we found here also—blood that showed the bodies had been completely exsanguinated and the heads of the two victims."

"The bodies were gone?" exclaimed Darwin Frontenac.

"Gone. There was the blood and the heads of our poor companions and that mark there on the trunk of the tree, and that was all—that mark, again, left by some enormous claw."

"The rifle?"

"Gone. So we came away, carrying their poor severed heads, or, rather, 'twas Hampden carried them, and this he did as he had the others—by the hair.

"'Twas little enough truly that we could do for our comrades now, but that little we would do. Perhaps at that very moment—I shuddered to think of it—their bodies were being feasted upon. But we could give their heads burial, and we did, raised a cross over the grave, and then we left that cursed place.

"There is no need to detail our return through that great defile. We had to abandon two of the sleds and the provisions that they carried. We did not leave them there, though, but found a good spot and made a depot, and there they are for any explorer who may follow. It was hard work, too, to handle so many dogs, but we did it and won steadily back along that terrible way we had come, taking with us the strangest story an explorer ever had to tell.

"Little did we dream that a discovery was to follow even more strange and wonderful than those wonderful and terrible Gardens of Paradise.

"At Discovery Depot, we went over to the talus where Hampden had made his great find. The fragment of pillar was too heavy for us to take away, but we carefully broke off a piece, though this seemed something very like sacrilege; if photographs couldn't convince them, certainly this stone with its harpies and palm-trees ought to do it.

"As I stretched out in my sleeping-bag that night, Hampden was sitting up in his, and he was still examining that sculptured fragment—or, rather, staring at it. I watched him for a time, for the brooding interest that he took in those figures—well, I couldn't help wondering.

"'What,' said I at last, 'do you find so fascinating? Is it the palm-trees or the harpies?'

"'The harpies,' Hampden told me. 'Did you notice—*their claws*?'

"I sat up in my bag and stared at him.

"'Hampden, what on earth do you mean?'

"That brooding look was gone from his face now, and, before ever he spoke, I knew what the answer would be.

"'Mean? Why do you think that I *meant* anything? Look at them, Captain. They are in more ways than one a striking piece of work—those claws.'

"I knew, though, what had been in Hampden's mind, and I cursed myself for a fool because I could not drive that thought from my own.

"It was on the 23rd of December that we left this camp, and two days later, on Christmas, came the discovery.

"It was in latitude 84° 25'. We were now near that great plain, the mountains, though, still towering up on every hand, very tumbled and jagged, and our way lying along a glacier that filled one of the deep valleys. We had swung over very close to the mountains on the right in hopes of finding a better way through the pressure ridges and the terrible sastrugi.

"The surface had looked better off in this direction, but, now that we were there, we found once more that things are not always as they seem. We were having a terrible

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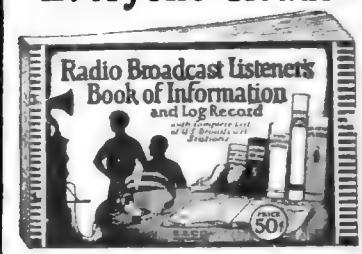

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time of it. It was mid-afternoon. The sun was shining clear and bright, the sky nearly cloudless. It was in one of our frequent halts, and I was leaning against the sled as we rested—or, I should have said, against the load on the sled—and was, as a man will do when he is doing nothing, studying the sides of a kind of gorge in the mountains.

"In a way (though I did not notice this at the time) this deep place was rather peculiarly situated, for into the greater part of it the sun's rays could never shine. In other words, the temperature in there could never rise to the melting point. You will see in a moment why I so particularly draw attention to this circumstance.

"Only here and there were the rocks themselves visible; snow and ice covered everything. There was the sunlit snow rising up all around, and the gorge itself in deep shadow. At first, what with the strong contrast, those depths, though masses of snow and ice themselves, seemed almost black. But, as I continued to gaze up into it, the obscurity that involved everything there seemed to thin out and pass away, like mist. I could make out masses and hollows that a few moments before had been totally invisible.

"A dark spot in particular claimed my attention. I didn't know why and don't know why yet, for I wasn't looking for anything, never dreamed that there might be something up there to find. In fact, as for these things that I was actually looking at, I wasn't *thinking* of them at all.

"I have said it was a dark spot, but there were, in fact, two, the darker (and smaller) one being above. Thus I went on with my examination, but certainly my thoughts, as I have remarked, were elsewhere—or, rather, it was as if I was thinking of two things at the same time, though that, I believe, is absurd. I soon perceived what it was: there had been a rock-slide up there and a recent one, too, if appearances were to be trusted. And that *very* dark spot—it appeared black no matter how hard I peered—what *was* that black thing there above?

"It seemed—it must be—yes, there could no longer be any doubt: it was the mouth of a cave!

"My thoughts were now any place but elsewhere! Still, so I thought the next moment, what was there in the discovery of this cavern mouth to call forth any great interest, any expectation whatever?

"'A cave,' said I; 'tis only a cave.'

"'Yes,' a little voice seemed to whisper in my ear, 'but, remember, sometimes things are found in caves.'

"Caves had been found in the Antarctic, but nothing had ever been found in them. Well, for the matter of that, explorers before us had never found geysers in the Antarctic, or sculptured stone, or Gardens of Paradise, with their palm-trees, their birds and flowers and that horror which had left the mark of its great claw. So there was no telling. Certainly it would do no harm to go and see.

"I got out my powerful glasses and examined the spot. This brought Hampden up alongside.

"'What's so interesting there?' he queried, gazing up.

"I handed him the glasses.

"'Tell me what you see?'

"'I see,' Hampden said, 'that the rock has slipped away up there. I should say, too, that the slip is a recent one.'

"'And that dark thing above. What is that?'

"'That is the mouth of a cave.'

"'Just what I thought. And I am going up and take a look inside that cave.'

"And here came a strange thing. Well has it been said that man is compounded of contradictions. I would never have expected to find Hampden showing no interest whatever in a moment such as this. Yet such was the case.

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"'No flowery climb,' he observed, 'and the chances are that you will find nothing in that cave but emptiness.'

"'Well,' I told him, 'I'll have the satisfaction of being sure, at any rate.'

"And so off I went, leaving Hampden leaning against the sled and watching me in that listless, half-vacuous manner that, considering the man's constitutional restlessness and curiosity, surprised me not a little.

"The going was pretty difficult, almost as much so in that gorge as amongst the pressure-waves and pressure-ridges and the sastrugi of the glacier.

"At last I stood at the foot of the slide, and there I stopped to take breath and make a survey of things.

"A great mass of rock had given way, and clearly this had occurred but a short time before. This broken mass had taken the form of a talus and gave access, steep but not so very difficult if one were careful, to the mouth of the cavern. My examination led me to the opinion that the cave, before the rock had given way, had been completely concealed or that, at any rate, the entrance had been a very small one then.

"Now, however, it had an entrance wide and dark and yawning, and up I started to get a look into it.

"I had got up to the entrance and had just stopped to look around when my eyes fell on a sight, there not more than a yard distant, so shockingly unexpected and strange as to cause me to cry out and start so violently that my hold slipped and I lost my balance and thought, for a sickening instant, that I was going to go plunging down backwards.

"But I got a grip and recovered my balance and looked again.

"Though I could look into the cave, I was not yet on a level with the floor; my head and shoulders only were that high. The cavern floor itself was a mass of ice some feet in thickness. When the rock had given way, this ice had been cracked clean across, the part broken off going down, of course, with the avalanche. This ice was not clear like that formed from water but had the whitish appearance of snow-ice. And yet it wasn't like snow-ice, either. It was transparent rather than translucent, and yet it was neither.

"And now, gentlemen, I will tell you what I saw.

"There, incased in that ice even as that fish was that you brought in and thawed out; there, plain and yet as though seen through a misty glass, the face within six or eight inches of the edge; there in that terrible bed of cloudy crystal—there lay the body of a girl, or, rather, of a very young woman!"

CHAPTER XII

"SHE ISN'T DEAD!"

"The sight, as you can easily imagine, was a shocking one truly. It gave me quite a turn. It was, however, though terribly so, a beautiful one, too. For she looked so fair and sweet and lovely.

"She lay on her back, the right knee drawn up a little, the left hand on her breast, her face turned towards me.

"Yes, so lovely and lifelike she looked that I could have imagined that she was only sleeping—if it had not been for the marble stillness of her bosom and that terrible look in her eyes.

"I had moved up farther and put my face close to the ice. I moved this way and that and at last was gazing straight into her eyes. I thought that they were blue, but of this could not be sure, for the pupils were extraordinarily dilated, giving the eyes a look that was horrible to see."

The explorer paused; he was looking at Darwin Frontenac in a strange manner.

"Belladonna, perhaps," said Frontenac.

"That was my thought, even then as I looked into them.

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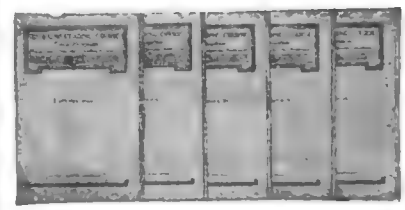

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"And can any one imagine how powerfully the sight of that poor girl, my poor Sleeping Beauty—how powerfully that terrible and yet beautiful sight affected me? I do not think so, and I shall not attempt to describe it.

"For a time my thoughts were in a kind of daze. At first I couldn't grasp the full meaning of it all. Whence had she come? How long had she lain here in her bed of crystal, in the heart of this frozen, desolate land.

"Then of a sudden the answer came, the sudden full realization of the wonderful and awful truth; and I dropped my head to the ice and for some moments leaned there motionless, for the thought—or, rather, the multitude of thoughts that came rushing into my mind—overwhelmed me.

"For this girl had been here for thousands upon thousands of years, suffering no bodily change whatever in the course of those untold, awful ages. Here she lay when Alexander led his Macedonians forth to the conquest of Asia, when Hannibal threatened the might of Rome, when Achilles and Hector fought before the walls of Troy, ere the first king ascended to the throne of the Egyptians or the Chaldaeans.

"Why, here she lay, even as I saw her now, in the day of the Man of Neanderthal, he of Spy and the Man of Piltdown. Yes, back through the mists and darkness of the prehistoric ages, and back and back, and yet she lay here sleeping then—even in those dim days when, as the saying has it, the world was young. Sometimes I wonder if it hasn't always been old.

"For a long time—how long I did not know and do not know now—I stood there looking, then started back.

"I found that a remarkable change had come over Hampden. That listless, half-vacuous manner was gone; what I saw was just the opposite.

"'What on earth, Captain,' he called out as I was coming up, 'did you find up there?'

"'How,' I asked him, 'do you know that I did find something?'

"He tapped the glasses.

"I was watching. I thought once, just as you got to the top, that you were going to fall over backwards. It looked as though you got something of a shock.'

"I did not answer until I stood before him.

"'Hampden,' I then said, 'a stranger sight than the one that met my eyes at that moment no man on this earth has ever seen!'

"He made an exclamation and stared at me.

"'Tis so,' I told him. 'And God only knows what else may be there in that cave. We must explore that place. We make camp right here and now; then get your camera, and we are off.'

"I knew that, as a speedy affair, the making of this camp would be a record-smasher; but the thing was done, and we were off for the cave, sooner than I had expected.

"'Now, I warn you, Hampden,' I said as we went along, 'that you are going to get a shock too, when we reach that cave. So be prepared.'

"'But why on earth won't you tell me what it is?'

"'No; you must wait and see.'

"Were I to live to be a very, very aged man (which, of course, I shall never do) the picture which memory has of that look which came to Hampden's face when at last he stood there and saw her could never fade in even the slightest detail—when at last he was there before that bed of ice and saw my poor Sleeping Beauty.

"For a long time he stood and just looked, and then at last he spoke.

"'Poor little kid!' is what he said.

"And I saw tears in his eyes, and I knew that there were tears in my own.

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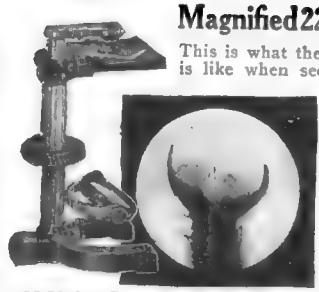

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"'One would think,' I said, 'that she is only sleeping.'

"'Sleeping!' exclaimed Hampden.

"He moved up close to the ice as I had done and gazed eagerly in upon the still face. Of a sudden he became excited. I could see his hand trembling. The face he turned toward me was bright with some powerful emotion and yet dark with horror.

"'Sleeping!' he exclaimed a little wildly. 'Great God, Captain Livingstone.—"

"'In Heaven's name,' I asked after waiting a moment or so, 'what is it?'

"'God in Heaven,' Hampden cried, *'she isn't dead!'"*

(To be continued)

STATEMENT

Of the Ownership, Management, Circulation, Etc., required by the Act of Congress of August 24, 1912, of SCIENCE AND INVENTION, published monthly at New York, N. Y., for Oct. 1, 1924.

State of New York } ss.
County of New York }

Before me, a notary public in and for the State and county aforesaid, personally appeared Hugo Gernsback, who, having been duly sworn according to law, deposes and says that he is the Editor of SCIENCE AND INVENTION and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, The Experimenter Publishing Co., Inc, 53 Park Place, New York, N. Y. Editor, Hugo Gernsback, 53 Park Place, New York, N. Y. Managing Editor, H. Winfield Secor, 53 Park Place, New York, N. Y. Business Manager, R. W. DeMott, 53 Park Place, New York, N. Y.

2. That the owner is: (If the publication is owned by an individual his name and address, or if owned by more than one individual the name and address of each, should be given below; if the publication is owned by a corporation the name of the corporation and the names and addresses of the stockholders owning or holding one per cent or more of the total amount of stock should be given.) The Experimenter Publishing Co., Inc., 53 Park Place, New York, N. Y. Hugo Gernsback, Sidney Gernsback, R W. DeMott, H. W. Secor, Dr. T. O'Conor Sloane and Mrs. Catherine Major all of 53 Park Place, New York, N. Y., M. M. Finucan, 720 Cass St., Chicago, Ill.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the six months preceding the date shown above is..... (This information is required from daily publications only.)

H. GERNSBACK.

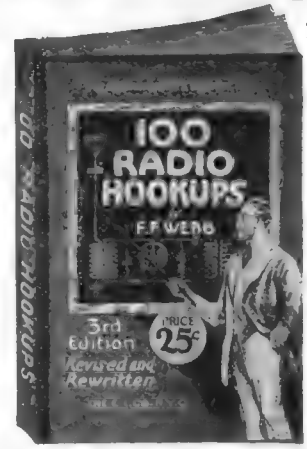
Sworn to and subscribed before me this 18th day of September, 1924.
(Seal) Joseph H. Kraus.
Notary Public

My commission expires March 30, 1925. Queens County Register's No. 2951. New York County Register's No. 5291. New York County Clerk's No. 379.

ENGLISH RADIO STATION

It is interesting to note that the new high power radio station at Chelmsford, Eng., will use a wave-length between 1,500 and 2,000 meters.

100 Radio Hook-Ups



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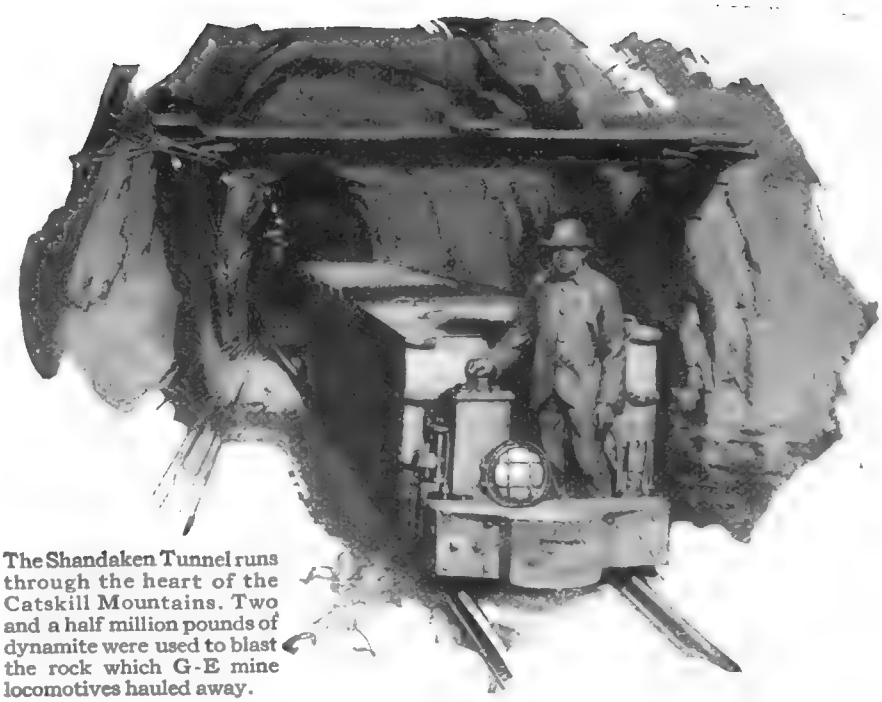
Radio Broadcast

REVISED AND CORRECTED TO DATE.

First Group of Figures Indicate the Power in Watts in the Antenna of the Transmitting Station. The Second Group Gives the Wave-Length.

Call Letters	Location and Name	Power & Wave Length
KDKA	East Pittsburgh, Pa., Westinghouse Electric & Mfg. Co.	1000—325
KDPM	Cleveland, Ohio, Westinghouse Electric & Mfg. Co.	500—270
KDPT	San Diego, Calif, Southern Electrical Co.	50—244
KDYL	Salt Lake City, Utah, Newhouse Hotel	100—360
KDYM	San Diego, Calif., Savoy Theatre	100—280
KDYQ	Portland, Ore., Oregon Institute of Technology	50—360
KDZB	Bakersfield, Calif., Frank E. Siefert	100—240
KDZE	Seattle, Wash., Rhodes Department Store	100—270
KDZR	Bellingham, Wash., Bellingham Publishing Co.	50—261
KFAD	Phoenix, Ariz., McArthur Bros. Mercantile Co.	100—360
KFAE	Pullman, Wash., State College of Washington	500—330
KFAF	Denver, Colo., Western Radio Corp.	500—278
KFAJ	Boulder, Colo., University of Colorado	100—261
KFAN	Moscow, Idaho, The Electric Shop	50—360
KFAR	Hollywood, Calif., Studio Lighting Service Co.	100—280
KFAU	Boise, Idaho, Independent School District of Boise City, Boise High School	150—270
KFAW	Santa Ana, Calif., The Radio Den	10—280
KFAY	Medford, Ore., Virgin's Radio Service	50—283
KFBB	Havre, Mont., F. A. Buttrey & Co.	50—360
KFBC	San Diego, Calif., W. K. Azbill	5—278
KFBE	San Luis Obispo, Calif., Reuben H. Horn	50—242
KFBG	Tacoma, Wash., First Presbyterian Church	50—360
KFBK	Sacramento, Calif., Kimball-Upson Co.	100—283
KFBL	Everett, Wash., Leese Bros.	15—224
KFBS	Trinidad, Colo., Trinidad Gas & Electric Supply Co. and The Chronicle News	10—280
KFBU	Laramie, Wyo., The Cathedral	50—283
KFCB	Phoenix, Ariz., Nielson Radio Supply Co.	10—238
KFCF	Walla Walla, Wash., Frank A. Moore	100—360
KFCL	Los Angeles, Calif., Leslie E. Rice. Los Angeles Union Stock Yards	500—236
KFCP	Ogden, Utah, Ralph W. Flygare	10—360
KFCV	Houston, Tex., Fred Mahaffey, Jr.	10—360
KFCZ	Omaha, Nebr., Omaha Central High School	50—258
KFDD	Boise, Idaho, St. Michaels Cathedral	10—252
KFDH	Tucson, Ariz., University of Arizona	50—268
KFDJ	Corvallis, Ore., Oregon Agricultural College	50—360
KFDL	Denver, Colo., Knight-Campbell Music Co.	5—226
KFDX	Shreveport, La., First Baptist Church	100—360
KFDY	Brookings, S. Dak., South Dakota State College	150—360
KFDZ	Minneapolis, Minn., Harry O. Iverson	5—231
KFEC	Portland, Ore., Meier & Frank Co.	50—248
KFEL	Denver, Colo., Winner Radio Corp.	50 254
KFEQ	Oak, Nebr., Scroggin & Co. Bank	100—268
KFER	Fort Dodge, Iowa, Auto Electric Service Co.	10—231
KFEX	Minneapolis, Minn., Augsburg Seminary	100—261
KFEY	Kellogg, Idaho, Bunker Hill & Sullivan Mining & Concentrating Co.	10—360
KFFB	Boise, Idaho, Jenkins Furniture Co.	10—240
KFFE	Pendleton, Ore., Eastern Oregon Radio Co.	10—360
KFFP	Moberly, Mo., First Baptist Church	50—266
KFFR	Sparks, Nev., Nevada State Journal	10—226
KFFV	Lamoni, Iowa, Graceland College	100—280
KFFY	Alexandria, La., Pincus & Murphey Music House	50—275
KFGC	Baton Rouge, La., Louisiana State University	100—254
KFGD	Chickasha, Okla., Chickasha Radio & Electric Co.	100—248



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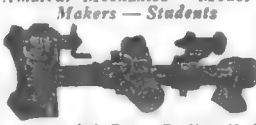

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KFGL	Arlington, Ore., Snell & Irby	10—234
KFGQ	Boone, Iowa, Crary Hardware Co.	10—226
KFGX	Orange, Tex., First Presbyterian Church	500—250
KFGZ	Berrien Springs, Mich., Emmanuel Missionary College.	500—286
KFHA	Gunnison, Colo., Western State College of Colorado	50—252
KFHD	St. Joseph, Mo., Utz Electric Shop Co.	100—226
KFHH	Neah Bay, Wash., Ambrose A. McCue	50—261
KFHJ	Santa Barbara, Calif., Fallon & Co.	100—360
KFHR	Seattle, Wash., Star Electric & Radio Co.	50—283
KFI	Los Angeles, Calif., Earle C. Anthony (Inc.)	500—469
KFIF	Portland, Ore., Benson Polytechnic Institute	100—360
KFIO	Spokane, Wash., North Central High School	50—252
KFIQ	Yakima, Wash., First Methodist Church	50—242
KFIU	Juneau, Alaska, Alaska Electric Light & Power Co.	10—226
KFIX	Independence, Mo., Reorganized Church of Jesus Christ of Latter Day Saints	250—240
KFIZ	Fond du Lac, Wis., Daily Commonwealth & Oscar A. Huelsman	100—273
KFJB	Marshalltown, Iowa, Marshall Electric Co.	10—248
KFJC	Seattle, Wash., Seattle Post Intelligencer	100—270
KFJF	Oklahoma, Okla., National Radio Mfg. Co.	20—252
KFJI	Astoria, Ore., Liberty Theatre.	10—252
KFJK	Bristow, Okla., Delano Radio & Electric Co.	100—233
KFJL	Ottumwa, Iowa, Hardsacg Mfg. Co.	10—242
KFJM	Grand Forks, N. Dak., University of North Dakota	100—280
KFJQ	Grand Forks, N. Dak., Electric Construction Co., Valley Radio Division	5—280
KFJR	Stevensville, Mont. (near), Ashley C. Dixon & Son	5—258
KFJX	Cedar Falls, Iowa, Iowa State Teachers' College	50—280
KFJY	Fort Dodge, Iowa, Tunwall Radio Co.	50—246
KFJZ	Fort Worth, Tex., Texas National Guard, 112th Cavalry	20—254
KFKA	Greeley, Colo., Colorado State Teachers College	50—273
KFKB	Milford, Kans., Brinkley-Jones Hospital Assn.	500—286
KFKQ	Conway, Ark., Conway Radio Laboratories	100—250
KFKV	Butte, Mont., F. F. Gray	50—283
KFKX	Hastings, Nebr., Westinghouse Electric & Mfg. Co.	1000—341
KFKZ	Colorado Springs, Colo., Nassour Bros. Radio Co.	10—234
KFLA	Butte, Mont., Abner R. Willson	5—283
KFLB	Menominee, Mich., Signal Electric Mfg. Co.	50—248
KFLD	Franklinton, La., Paul E. Greenlaw	10—234
KFLE	Denver, Colo., National Educational Service	25—268
KFLQ	Little Rock, Ark., Bizzell Radio Shop	20—261
KFLR	Albuquerque, N. Mex., University of New Mexico	100—254
KFLU	San Benito, Tex., Rio Grande Radio Supply House	100—236
KFLV	Rockford, Ill., Swedish Evangelical Mission Church	100—229
KFLW	Missoula, Mont., Missoula Electric Supply Co.	5—234
KFLX	Galveston, Tex., George R. Clough	10—240
KFLZ	Atlantic, Iowa, Atlantic Automobile Co.	100—273
KFMB	Little Rock, Ark., Christian Churches of Little Rock	—254
KFMQ	Fayetteville, Ark., University of Arkansas	100—263
KFMR	Sioux City, Iowa, Morningside College	10—261
KFMT	Minneapolis, Minn., George W. Young	5—231
KFMW	Houghton, Mich., M. G. Sateren	50—266
KFMX	Northfield, Minn., Carleton College	500—283
KFNF	Shenandoah, Iowa, Henry Field Seed Co.	500—266
KFNG	Coldwater, Miss., Wooten's Radio Shop	10—254
KFNJ	Warrensburg, Mo., Warrensburg Electric Shop	50—234
KFNL	Paso Robles, Calif., Radio Broadcast Assn.	10—240
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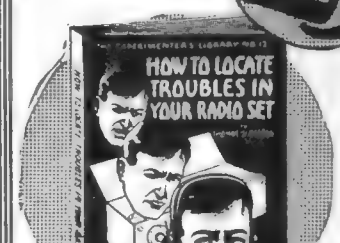

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KFOC	Whittier, Calif., First Christian Church	100—236
KFOD	Wallace, Idaho, The Radio Shop	10—224
KFOF	Marshfield, Ore., Rohrer Electric Co.	10—240
KFOJ	Moberly, Mo., Moberly High School Radio Club	5—246
KFOL	Marengo, Iowa, Leslie M. Shafbuch	10—234
KFON	Long Beach, Calif., Echophone Radio Shop	100—234
KFOO	Salt Lake City, Utah, Latter Day Saints University	10—261
KFOQ	Galveston, Tex., Ora W. Chancellor	50—240
KFOR	David City, Nebr., David City Tire & Electric Co.	20—226
KFOT	Wichita, Kans., College Hill Radio Club	50—231
KFOU	Richmond, Calif., Hommel Mfg. Co.	100—254
KFOX	Omaha, Nebr., Technical High School	100—248
KFOY	St. Paul, Minn., Beacon Radio Service	50—226
KFOZ	Fort Smith, Ark., Leon Hudson Real Estate Co.	20—233
KFPG	Los Angeles, Calif., Garretson & Dennis	100—238
KFPH	Salt Lake City, Utah, Harold C. Mailander	50—242
KFPL	Dublin, Texas, C. C. Baxter	15—242
KFPM	Greenville, Texas, New Furniture Co.	10—242
KFPN	Jefferson City, Mo., Missouri National Guard, 70th Infantry Brigade	10—242
KFPO	Denver, Colo., Colorado National Guard, 45th Division Tank Co.	500—231
KFPP	Olympia, Wash., G. & G. Radio & Electric Shop	20—236
KFPR	Los Angeles, Calif., Los Angeles County Forestry Department	500—231
KFPT	Salt Lake City, Utah, Cope & Johnson	500—268
KFPV	San Francisco, Calif., Heintz & Kohlmeos	50—236
KFPW	Carterville, Mo., St. Johns Church	10—268
KFPX	Pine Bluff, Ark., First Presbyterian Church	100—242
KFPY	Spokane, Wash., Symons Investment Co.	100—283
KFQA	St. Louis, Mo., The Principia	50—261
KFQB	Fort Worth, Texas, Searchlight Publishing Co.	100—254
KFQC	Taft, Calif., Kidd Brothers Radio Shop	100—227
KFQD	Anchorage, Alaska, Chovin Supply Co.	100—280
KFQE	Colorado Springs, Colo., Dickenson-Henry Radio Laboratories	5—224
KFQF	Minneapolis, Minn., Donald A. Boult	10—224
KFQG	Los Angeles, Calif., Armory Exposition Park, Southern California Radio Assn.	100—226
KFQH	Hillsbourgh, Calif., Albert Sherman	50—231
KFQI	Culver City, Calif., Thomas H. Ince Corp.	100—234
KFQJ	Oklahoma, Okla., Harbour-Longmire Co.	50—236
KFQK	Fayette, Mo., Democrat Leader	10—236
KFQL	Muskogee, Okla., Oklahoma Free State Fair Assn.	20—252
KFQM	Austin, Texas, Texas Highway Bulletin	100—268
KFQN	Portland, Ore., Third Baptist Church	5—283
KFQO	Russell, Kans., Meier Radio Shop	10—261
KFQP	Iowa City, Iowa, George S. Carson, Jr.	10—224
KFQR	Oklahoma, Okla., Walter L. Ellis	10—250
KFQS	Manitou, Colo., Dickenson-Henry Radio Laboratories	10—246
KFQT	Denison, Texas, Texas National Guard, 36th Signal Company	10—252
KFQU	Holy City, Calif., W. Riker	100—234
KFQV	Omaha, Nebr., Omaha Grain Exchange	100—231
KFQW	North Bend, Wash., C. F. Knierim Photo Radio & Electric Shop	50—248
KFQX	Seattle, Wash., Alfred M. Hubbard	250—233
KFQY	Belden, Nebr., Farmers State Bank	10—273
KFQZ	Hollywood, Calif., Taft Radio Co.	250—240
KFSG	Los Angeles, Calif., Echo Park Evangelistic Assn.	500—278
KFSY	Helena, Mont., Van Blaricom Co.	10—261
KGB	Tacoma, Wash., Tacoma Daily Ledger	50—252

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KGG	Portland, Ore., Hallock & Watson Radio Service	50—360
KGO	Oakland, Calif., General Electric Co.	1000—312
KGU	Honolulu, Hawaii, Marion A. Mulrony	500—360
KGW	Portland, Ore., Portland Morning Oregonian	500—492
KGY	Lacey, Wash., St. Martins College	5—258
KHJ	Los Angeles, Calif., Times-Mirror Co.	500—395
KHQ	Seattle, Wash., Louis Wasmer (Excelsior Motorcycle & Bicycle Co.)	100—360
KJQ	Stockton, Calif., C. O. Gould	5—273
KJR	Seattle, Wash., Northwest Radio Service Co.	50—283
KJS	Los Angeles, Calif., Bible Institute of Los Angeles	750—360
KLS	Oakland, Calif., Warner Bros. Radio Supplies Co.	250—360
KLX	Oakland, Calif., Tribune Publishing Co.	500—509
KLZ	Denver, Colo., Reynolds Radio Co.	500—283
KMJ	Fresno, Calif., San Joaquin Light and Power Corp.	50—248
KMO	Tacoma, Wash., Love Electric Co.	10—360
KNT	Kukak Bay, Alaska, Walter Hemrich	100—263
KNX	Los Angeles, Calif., Electric Lighting Supply Co.	100—360
KOB	State College, N. M., New Mexico College of Agriculture and Mechanic Arts	500—360
KOP	Detroit, Mich., Detroit Police Department	500—286
KPO	San Francisco, Calif., Hale Bros.	500—423
KQP	Hood River, Ore., Apple City Radio Club	10—360
KQV	Pittsburgh, Pa., Doubleday-Hill Electric Co.	500—270
KQW	San Jose, Calif., Charles D. Herrold	50—360
KRE	Berkeley, Calif., Berkeley Daily Gazette	50—275
KSD	St. Louis, Mo., Post Dispatch	500—546
KTW	Seattle, Wash., First Presbyterian Church	750—360
KUO	San Francisco, Calif., Examiner Printing Co.	150—360
KUY	El Monte, Calif., Coast Radio Co.	50—256
KWG	Stockton, Calif., Portable Wireless Telephone Co.	50—360
KWH	Los Angeles, Calif., Los Angeles Examiner	250—360
KYQ	Honolulu, Hawaii, The Electric Shop	100—270
KYW	Chicago, Ill., Westinghouse Electric & Mfg. Co.	1000—536
KZM	Oakland, Calif., Preston D. Allen	100—360
WAAB	New Orleans, La., Valdemar Jensen	100—268
WAAC	New Orleans, La., Tulane University	400—360
WAAD	Cincinnati, Ohio, Ohio Mechanics Institute	25—360
WAAF	Chicago, Ill., Chicago Daily Drovers Journal	200—286
WAAM	Newark, N. J., I. R. Nelson Co.	250—263
WAAN	Columbia, Mo., University of Missouri	50—254
WAAW	Omaha, Neb., Omaha Grain Exchange	500—286
WABB	Harrisburg, Pa., Harrisburg Sporting Goods Co.	10—266
WABD	Dayton, Ohio, Parker High School	5—283
WABE	Washington, D. C., Young Men's Christian Assn.	100—283
WABH	Sandusky, Ohio, Lake Shore Tire Co.	10—240
WABI	Bangor, Me., Bangor Railway & Electric Co.	100—240
WABL	Storrs, Conn., Connecticut Agricultural College	100—283
WABM	Saginaw, Mich., F. E. Doherty Automotive & Radio Equipment Co.	100—254
WABN	La Crosse, Wis., Ott Radio, Inc.	500—244
WABO	Rochester, N. Y., Lake Avenue Baptist Church	10—283
WABP	Dover, Ohio, Robert F. Weinig	200—266
WABQ	Haverford, Pa., Haverford College Radio Club	50—261
WABR	Toledo, Ohio, Scott High School	50—270
WABU	Camden, N. J., Victor Talking Machine Co.	50—226
WABW	Wooster, Ohio, College of Wooster	20—234
WABX	Mount Clemens, Mich. (near), Henry B. Joy	500—270
WABY	Philadelphia, Pa., John Magaldi, Jr.	50—242
WABZ	New Orleans, La., Colsieum Place Baptist Church	50—263
WBAA	West Lafayette, Ind., Purdue University	250—288

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WBAH	Minneapolis, Minn., The Dayton Co.	1000—417
WBAN	Paterson, N. J., Wireless Phone Corp.	100—244
WBAO	Decatur, Ill., James Millikin University	50—275
WBAP	Fort Worth, Texas, Wortham-Carter Publishing Co. (Star-Telegram)	750—476
WBAV	Columbus, Ohio, Erner & Hopkins Co.	500—423
WBAX	Wilkes-Barre, Pa., John H. Stenger, Jr.	20—360
WBAY	New York, N. Y., Western Electric Co.	500—492
WBBA	Newark, Ohio, Plymouth Congregational Church	20—240
WBBD	Reading, Pa., Barbey Battery Service	50—234
WBBG	Mattapoisett, Mass., Irving Vermilya	500—248
WBBH	Port Huron, Mich., J. Irving Bell	50—246
WBBL	Richmond, Va., Grace Covenant Church	5—283
WBBM	Lincoln, Ill., Frank Atlass Produce Co.	200—226
WBBN	Wilmington, N. C., A. B. Blake	10—275
WBBP	Petoskey, Mich., Petoskey High School	100—246
WBBR	Rossville, N. Y., Peoples Pulpit Assn.	500—273
WBBT	Philadelphia, Pa., Lloyd Bros.	5—234
WBBU	Monmouth, Ill., Jenks Motor Sales Co.	10—224
WBBV	Johnstown, Pa., Johnstown Radio Co.	5—248
WBBW	Norfolk, Va., Ruffner Junior High School	50—222
WBBY	Charleston, S. C., Washington Light Infantry	10—268
WBBZ	Indianapolis, Ind., Noble B. Watson	50—227
WBL	Anthony, Kans., T & H Radio Co.	100—254
WBS	Newark, N. J., D. W. May, Inc.	50—360
WBT	Charlotte, N. C., Southern Radio Corp.	250—360
WBZ	Springfield, Mass., Westinghouse Electric & Mfg. Co.	1000—337
WCAD	Canton, N. Y., St. Lawrence University	250—280
WCAE	Pittsburgh, Pa., Kaufmann & Baer Co.	500—462
WCAG	New Orleans, La., Clyde R. Randall	50—268
WCAH	Columbus, Ohio, Entrekin Electric Co.	100—286
WCAJ	University Place, Neb., Nebraska Wesleyan University	500—283
WCAK	Houston, Texas, Alfred P. Daniel	10—263
WCAL	Northfield, Minn., St. Olaf College	500—360
WCAO	Baltimore, Md., Sanders & Stayman Co.	50—360
WCAP	Washington, D. C., Chesapeake & Potomac Telephone Co.	500—469
WCAR	San Antonio, Texas, Southern Radio Corporation of Texas	100—360
WCAS	Minneapolis, Minn., William Hood Dunwoody Industrial Institute	100—280
WCAT	Rapid City, S. D., South Dakota State School of Mines	50—240
WCAU	Philadelphia, Pa., Durham & Co.	250—286
WCAV	Little Rock, Ark., J. C. Dice Electric Co.	10—360
WCAX	Burlington, Vt., University of Vermont	50—360
WCAY	Milwaukee, Wis., Hotel Antlers, Milwaukee Civic Broadcasting Assn.	250—266
WCAZ	Carthage, Ill., Carthage College	50—246
WCBA	Allentown, Pa., Charles W. Heimbach	10—280
WCBC	Ann Arbor, Mich., University of Michigan	200—280
WCBD	Zion, Ill., Wilbur G. Voliva	500—345
WCBE	New Orleans, La., Uhalt Radio Co.	5—263
WCBF	Pittsburgh, Pa., Paul J. Miller	50—236
WCBG	Pascagoula, Miss. (portable), Howard S. Williams	10—268
WCBH	Oxford, Miss. (near), University of Mississippi	10—242
WCBI	Bemis, Tenn., Nicoll, Duncan & Rush	50—240
WCBJ	Jennings, La., J. C. Mans	10—244
WCBK	St. Petersburg, Fla., E. Richard Hall	500—266
WCBL	Houlton, Me., Northern Radio Mfg. Co.	50—280
WCBM	Baltimore, Md., Charles Schwarz	50—229
WCBN	Fort Benjamin Harrison, Ind., James P. Boland, Lieut. U. S. A.	50—266
WCBO	Memphis, Tenn., Radio Shop, Inc.	20—250
WCBQ	Nashville, Tenn., First Baptist Church	100—236

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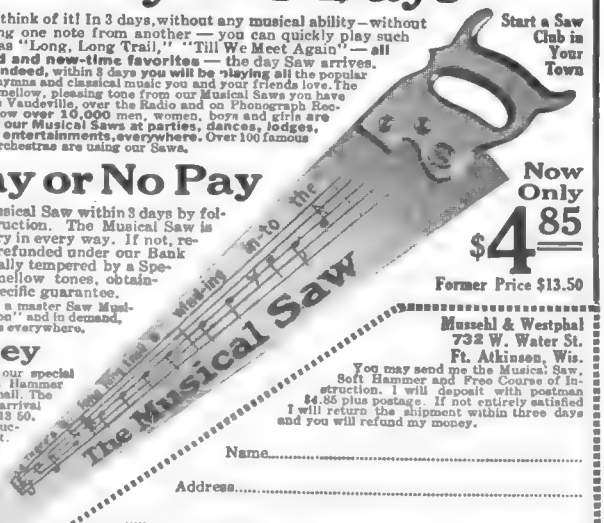

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Call Letters	Location and Name	Power & Wave Length
WCBR	Providence, R. I. (portable), Charles H. Messter	5—246
WCBT	Worchester, Mass., Clark University	250—238
WCBU	Arnold, Pa., Arnold Wireless Supply Co.	50—254
WCBV	Tullahoma, Tenn., Tullahoma Radio Club	10—252
WCBW	Macon, Ga., George P. Rankin, Jr., and Mitland Soloman	10—226
WCBX	Newark, N. J., Radio Shop of Newark	100—233
WCBY	Buck Hill Falls, Pa., Forks Electrical Shop	10—268
WCBZ	Chicago Heights, Ill., Coppotelli Bros. Music House	50—248
WCK	St. Louis, Mo., Stix-Baer & Fuller Dry Goods Co.	100—360
WCX	Detroit, Mich., Detroit Free Press	500—517
WDAE	Tampa, Fla., Tampa Daily Times	250—360
WDAF	Kansas City, Mo., Kansas City Star	500—411
WDAG	Amarilla, Texas, J. Laurance Martin	100—263
WDAH	El Paso, Texas, Trinity Methodist Church (South)	50—268
WDAR	Philadelphia, Pa., Lit Brothers	500—395
WDAS	Worcester, Mass., Sam Waite's Radio Shop	10—360
WDAU	New Bedford, Mass., Slocum & Kilburn	100—360
WDAY	Fargo, N. D., Radio Equipment Corporation	50—244
WDBB	Taunton, Mass., A. H. Waite & Co.	10—229
WDBC	Lancaster, Pa., Kirk, Johnson & Co.	50—258
WDBD	Martinsburg, W. Va., Herman E. Burns	5—268
WDBF	Youngstown, Ohio, Robert G. Phillips	50—246
WDBH	Worcester, Mass., C. T. Shear Co.	100—268
WDBI	St. Petersburg, Fla., Radio Specialty Co.	10—226
WDBJ	Roanoke, Va., Richardson-Wayland Electrical Corporation	50—229
WDBK	Cleveland, Ohio, M. F. Broz Furniture, Hardware & Radio Co.	100—248
WDBN	Bangor, Me., Maine Electric Light & Power Co.	5—252
WDBO	Winter Park, Fla., Rollins College	50—240
WDBP	Superior, Wis., Superior State Normal School	50—261
WDBQ	Salem, N. J., Morton Radio Supply Co.	10—234
WDBR	Boston, Mass., Tremont Temple Baptist Church	100—256
WDBS	Dayton, Ohio, S. M. K. Radio Corp.	5—283
WDBT	Hattiesburg, Miss., Taylor's Book Store	10—236
WDBU	Skowhegan, Me., Somerset Radio Co.	10—258
WDBV	Fort Wayne, Ind., Strand Theatre	100—258
WDBW	Columbia, Tenn., The Radio Den	20—268
WDBX	New York, N. Y., Otto Baur	5—233
WDBY	Chicago, Ill., North Shore Congregational Church	500—258
WDBZ	Kingston, N. Y., Boy Scouts of America (Ulster County Council)	5—233
WDM	Washington, D. C., Church of the Covenant	50—234
WDZ	Tuscola, Ill., James L. Bush	10—278
WEAA	Flint, Mich., Police Building, Frank D. Fallain	50—280
WEAF	New York, N. Y., American Telep. & Teleg. Co.	1000—492
WEAH	Wichita, Kans., Wichita Board of Trade	50—280
WEAI	Ithaca, N. Y., Cornell University	500—286
WEAJ	Vermilion, S. Dak., University of South Dakota	100—283
WEAM	North Plainfield, N. J., Borough of North Plainfield	150—286
WEAN	Providence, R. I., Shepard Co.	100—273
WEAO	Columbus, Ohio, Ohio State University	500—360
WEAP	Mobile, Ala., Mobile Radio Co.	100—360
WEAR	Baltimore, Md., Evening News Publishing Co.	50—261
WEAU	Sioux City, Iowa, Davidson Bros. Co.	100—275
WEAY	Houston, Tex., Iris Theatre	500—360
WEB	St. Louis, Mo., Benwood Co.	100—273
WEBA	Highland Park, N. J., The Electric Shop	15—233
WEBC	Superior, Wis., Walter C. Bridges	10—242
WEBD	Anderson, Ind., Electrical Equipment & Service Co.	10—246
WEBE	Cambridge, Ohio, Roy W. Waller	10—248
WEBH	Chicago, Ill., Edgewater Beach Hotel Co.	1000—370
WEBI	Salisbury, Md., Walter Gibbons	15—242
WEBJ	New York, N. Y., Third Avenue Ry. Co.	500—273

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Call Letters	Location and Name	Power & Wave Length
WEBK	Grand Rapids, Mich., Grand Rapids Radio Co.	20—261
WEBL	United States, R. C. A.	100—226
WEBP	New Orleans, La., E. Budd Peddicord	50—280
WEV	Houston, Tex., Hurlburt-Still Electrical Co.	100—263
WEW	St. Louis, Mo., St. Louis University	100—280
WFAA	Dallas, Tex., Dallas News & Dallas Journal	500—476
WFAB	Syracuse, N. Y., Carl F. Woese	100—234
WFAM	St. Cloud, Minn., Times Publishing Co.	10—273
WFAN	Hutchinson, Minn., Hutchinson Electric Service Co.	100—286
WFAV	Lincoln, Nebr., University of Nebraska	250—275
WFBB	Eureka, Ill., Eureka College	50—240
WFBG	Altoona, Pa., William F. Gable Co.	100—261
WFBH	New York, N. Y., Concourse Radio Corp.	500—273
WFI	Philadelphia, Pa., Strawbridge & Clothier	500—395
WGAL	Lancaster, Pa., Lancaster Electric Supply & Construction Co.	10—248
WGAN	Pensacola, Fla., Cecil E. Lloyd	50—360
WGAQ	Shreveport, La., Youree Hotel	150—252
WGAZ	South Bend, Ind., South Bend Tribune	250—360
WGI	Medford Hillside, Mass., American Radio & Research Corp.	100—360
WGL	Philadelphia, Pa., Thomas F. J. Howlett	500—360
WGN	Chicago, Ill., The Tribune (Drake Hotel - Whitestone Co.)	1000—370
WGR	Buffalo, N. Y., Federal Telep. Mfg. Co.	750—319
WGY	Schenectady, N. Y., General Electric Co.	1000—380
WHA	Madison, Wis., University of Wisconsin	500—360
WHAA	Iowa City, Iowa, State University of Iowa	500—484
WHAD	Milwaukee, Wis., Marquette University	100—280
WHAG	Cincinnati, Ohio, University of Cincinnati	100—222
WHAH	Joplin, Mo., Hafer Supply Co.	250—283
WHAK	Clarksburg, W. Va., Roberts Hardware Co.	15—258
WHAM	Rochester, N. Y., University of Rochester	100—283
WHAR	Atlantic City, N. J., Seaside Hotel	100—275
WHAS	Louisville, Ky., Courier-Journal & Louisville Times	500—400
WHAV	Wilmington, Del., Wilmington Electrical Specialty Co.	100—503
WHAZ	Troy, N. Y., Rennselaer Polytechnic Institute	500—380
WHB	Kansas City, Mo., Sweeney School Co.	500—411
WHK	Cleveland, Ohio, Radiovox Co.	100—283
WHN	New York, N. Y., George Schubel	500—360
WHO	Des Moines, Iowa, Bankers Life Co.	500—526
WIAB	Rockford, Ill., Art. A. Johnson Garage	50—252
WIAC	Galveston, Tex., Galveston Tribune	100—360
WIAD	Philadelphia, Pa., Howard R. Miller	100—254
WIAK	Omaha, Nebr., Journal-Stockman Co.	250—278
WIAQ	Marion, Ind., Chronicle Publishing Co.	10—226
WIAS	Burlington, Iowa, Home Electric Co.	100—283
WIK	McKeesport, Pa., K. & L. Electric Co.	100—234
WIL	Washington, D. C., Continental Electrical Supply Co.	5—360
WIP	Philadelphia, Pa., Gimbel Brothers	500—509
WJAB	Lincoln, Nebr., American Electric Co.	100—229
WJAD	Waco, Tex., Jackson's Radio Engineering Laboratories	150—360
WJAG	Norfolk, Nebr., Norfolk Daily News	250—283
WJAK	Greentown, Ind., Clifford L. White	30—254
WJAM	Cedar Rapids, Iowa, D. M. Perham	20—268
WJAN	Peoria, Ill., Peoria Star	100—280
WJAR	Providence, R. I., The Outlet Co.	500—360
WJAS	Pittsburgh, Pa., Pittsburgh Radio Supply House	500—286
WJAX	Cleveland, Ohio, Union Trust Co.	500—390
WJAZ	Chicago, Ill., Chicago Radio Laboratory	20—268
WJD	Granville, Ohio, Denison University	10—229
WJY	New York, N. Y., R. C. A.	750—405
WJZ	New York, N. Y., R. C. A.	500—455
WKAA	Cedar Rapids, Iowa, H. F. Paar	50—278
WKAD	East Providence, R. I., Charles Looff (Crescent Park)	20—240
WKAF	Wichita Falls, Tex., W. S. Radio Supply Co.	100—360

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Name .....

Address .....

Post Office ..... *State* .....

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Nationality or Color ..... *Age* ..... *Own* ☐ *Rent* ☐ *Married* ☐ *Single* ☐

Present Occupation ..... *Employers Name* .....

Give names of merchants who know you personally

Name ..... *Town* ..... *State* .....

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Call Letters	Location and Name	Power & Wave Length
WKAN	Montgomery, Ala., United Battery Service Co.	15—226
WKAP	Cranston, R. I., Dutee W. Flint	50—360
WKAQ	San Juan, P. R., Radio Corp. of Porto Rico	100—360
WKAR	East Lansing, Mich., Michigan Agricultural College	500—280
WKAV	Laconia, N. H., Laconia Radio Club	50—254
WKBF	Cranston, R. I., Dutee W. Flint	500—286
WKY	Oklahoma, Okla., WKY Radio Shop	100—360
WLAG	Minneapolis, Minn., Cutting & Washington Radio Corp.	500—417
WLAH	Syracuse, N. Y., Samuel Woodworth	100—234
WLAL	Tulsa, Okla., Naylor Electrical Co.	100—360
WLAP	Louisville, Ky., W. V. Jordan	20—286
WLAQ	Kalamazoo, Mich., Arthur E. Schilling	10—285
WLAX	Greencastle, Ind., Greencastle Community Broadcasting Station	10—231
WLB	Minneapolis, Minn., University of Minnesota	5—360
WLBL	Stevens Point, Wis., Wisconsin Department of Markets	500—278
WLS	Chicago, Ill., Sears, Roebuck & Co.	500—345
WLW	Cincinnati, Ohio, Crosley Radio Corp.	500—423
WMAC	Cazenovia, N. Y., Clive B. Meredith	100—261
WMAF	Dartmouth, Mass., Round Hills Radio Corp.	100—500—360
WMAH	Lincoln, Nebr., General Supply Co.	100—254
WMAK	Lockport, N. Y., Lockport Board of Commerce	500—273
WMAL	Trenton, N. J., Trenton Hardware Co.	50—256
WMAN	Columbus, Ohio, First Baptist Church	10—286
WMAQ	Chicago, Ill., Chicago Daily News	500—448
WMAV	Auburn, Ala., Alabama Polytechnic Institute	500—250
WMAY	St. Louis, Mo., Kingshighway Presbyterian Church	100—280
WMAZ	Macon, Ga., Mercer University	100—261
WMC	Memphis, Tenn., "Commercial Appeal"	500—500
WMH	Cincinnati, Ohio, Ainsworth-Gates Radio Co.	750—309
WMU	Washington, D. C., Doubleday-Hill Electric Co.	100—261
WNAC	Boston, Mass., Shepard Stores	100—278
WNAD	Norman, Okla., University of Oklahoma	50—360
WNAL	Omaha, Nebr., Omaha Central High School	20—258
WNAP	Springfield, Ohio, Wittenberg College	100—275
WNAR	Butler, Mo., First Christian Church	20—231
WNAT	Philadelphia, Pa., Lenning Brothers	100—360
WNAW	Fort Monroe, Va., Henry Kunzmann	5—360
WNAX	Yankton, S. Dak., Dakota Radio Apparatus Co.	100—244
WNYC	New York, N. Y., City of New York	1000—526
WOAC	Lima, Ohio, Page Organ Co.	50—266
WOAE	Fremont, Nebr., Midland College	15—280
WOAF	Tyler, Tex., Tyler Commercial College	10—360
WOAG	Belvidere, Ill., Apollo Theatre	100—273
WOAI	San Antonio, Tex., Southern Equipment Co.	500—385
WOAJ	Parsons, Kans., Ervins Electrical Co.	15—258
WOAN	Lawrenceburg, Tenn., James D. Vaughn	200—360
WOAO	Mishawaka, Ind., Lyradion Mfg. Co.	50—360
WOAR	Kenosha, Wis., Henry P. Lundskow	50—229
WOAT	Wilmington, Del., Boyd M. Hamp	100—360
WOAV	Erie, Pa., Pennsylvania National Guard, 112th Infantry	50—242
WOAW	Omaha, Nebr., Woodmen of the World	500—526
WOAX	Trenton, N. J., Franklyn J. Wolff	500—240
WOC	Davenport, Iowa, Palmer School of Chiropractic	500—484
WOI	Ames, Iowa, Iowa State College	500—360
WOO	Philadelphia, Pa., John Wanamaker	500—509
WOQ	Kansas City, Mo., Western Radio Co.	500—360
WOR	Newark, N. J., L. Bamberger & Co.	500—405
WOS	Jefferson City, Mo., Missouri State Marketing Bureau	500—441
WPAB	State College, Pa., Pennsylvania State College	500—283
WPAC	Okmulgee, Okla., Donaldson Radio Co.	100—360
WPAJ	New Haven, Conn., Doolittle Radio Corp.	100—268
WPAK	Agricultural College, N. Dak., North Dakota Agricultural College	50—283

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Call Letters	Location and Name	Power & Wave Length
WPAL	Columbus, Ohio, Avery & Loeb Electric Co.	500—286
WPAM	Topeka, Kans., Auerbach & Guettel	100—275
WPAR	Beloit, Kans., Ward Battery & Radio Co.	10—236
WPAU	Moorehead, Minn., Concordia College	10—286
WPAZ	Charleston, W. Va., John R. Koch (Dr.)	10—273
WQAA	Parkesburg, Pa., Horace A. Beale, Jr.	500—360
WQAC	Amarillo, Tex., Gish Radio Service	100—234
WQAE	Springfield, Vt., Moore Radio News Station	50—275
WQAF	Sandusky, Ohio, Sandusky Register	5—240
WQAM	Miami, Fla., Electrical Equipment Co.	100—283
WQAN	Scranton, Pa., Scranton Times	100—280
WQAO	New York, N. Y., Calvary Baptist Church	100—360
WQAQ	Abilene, Tex., West Texas Radio Co. (Abilene Daily Reporter)	100—360
WQAS	Lowell, Mass., Prince-Walter Co.	100—266
WQAX	Peoria, Ill., Radio Equipment Co.	100—248
WQJ	Chicago, Ill., Calumet Rainbow Broadcasting Co.	500—448
WRAF	Laporte, Ind., The Radio Club	10—224
WRAL	St. Croix Falls, Wis., Northern States Power Co.	100—248
WRAM	Galesburg, Ill., Lombard College	100—244
WRAN	Waterloo, Iowa, Black Hawk Electrical Co.	10—236
WRAO	St. Louis, Mo., St. Louis Radio Service Co.	10—360
WRAV	Yellow Springs, Ohio, Antioch College	100—242
WRAW	Reading, Pa., Avenue Radio Shop	10—238
WRAX	Gloucester City, N. J., Flexon's Garage	100—268
WRBC	Valparaiso, Ind., Immanuel Lutheran Church	500—278
WRC	Washington, D. C., Radio Corp. of America	500—469
WRK	Hamilton, Ohio, Doron Bros. Electrical Co.	200—360
WRL	Schenectady, N. Y., Union College	500—360
WRM	Urbana, Ill., University of Illinois	500—360
WRR	Dallas, Tex., City of Dallas, Police and Fire Signal Department	30—360
WRW	Tarrytown, N. Y., Tarrytown Radio Research Laboratory	500—273
WSAB	Cape Girardeau, Mo., Southeast Missouri State Teachers College	100—360
WSAC	Clemson College, S. C., Clemson Agricultural College	500—360
WSAD	Providence, R. I., J. A. Foster Co.	100—261
WSAI	Cincinnati, Ohio, United States Playing Card Co.	500—309
WSAJ	Grove City, Pa., Grove City College	250—258
WSAP	New York, N. Y., Seventh Day Adventist Church	250—263
WSAR	Fall River, Mass., Doughty & Welch Electrical Co.	100—254
WSAU	Chesham, N. H., Camp Marienfeld	10—229
WSAV	Houston, Tex., Clifford W. Vick Radio Construction Co.	100—360
WSAY	Port Chester, N. Y., Irving Austin (Port Chester Chamber of Commerce)	100—233
WSAZ	Pomeroy, Ohio, Chase Electric Shop	50—258
WSB	Atlanta, Ga., Atlanta Journal.	500—429
WSL	Utica, N. Y., J. & M. Electric Co.	10—273
WSOE	Milwaukee, Wis., School of Engineering of Milwaukee.	100—246
WSY	Birmingham, Ala., Alabama Power Co.	500—360
WTAB	Fall River, Mass., Fall River Daily Herald Publishing Co.	100—266
WTAC	Johnstown, Pa., Penn. Traffic Co.	150—275
WTAF	New Orleans, La., Louis J. Gallo	10—268
WTAJ	Portland, Me., The Radio Shop	10—236
WTAL	Toledo, Ohio, Toledo Radio & Electric Co.	10—252
WTAM	Cleveland, Ohio, Willard Storage Battery Co.	1000—390
WTAP	Cambridge, Ill., Cambridge Radio & Electric Co.	50—242
WTAQ	Osseo, Wis., S. H. Van Gorden & Son	100—254
WTAR	Norfolk, Va., Reliance Electric Co.	100—280
WTAS	Elgin, Ill. (near), Charles E. Erbstein	500—286
WTAT	Boston, Mass. (portable), Edison Electric Illuminating Co.	100—244

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Call Letters	Location and Name	Power & Wave Length
WTAU	Tecumseh, Nebr., Ruegg Battery & Electric Co.	10—242
WTAW	College Station, Tex., Agricultural & Mechanical College of Texas	250—280
WTAX	Streator, Ill., Williams Hardware Co.	50—231
WTAY	Oak Park, Ill., Oak Leaves Broadcasting Station	500—283
WTAZ	Lambertville, N. J., Thomas J. McGuire	15—283
WTG	Manhattan, Kans., Kansas State Agricultural College	50—273
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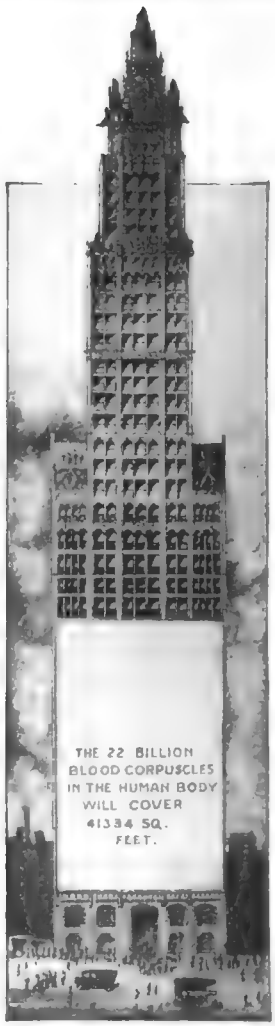
WWJ	Detroit, Mich., Detroit News	500—517
WWL	New Orleans, La., Loyola University	5—280



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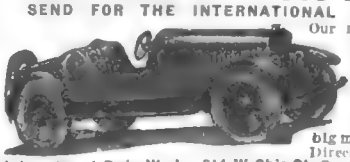
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Readers Forum

(*Continued from page 791*)

convection current at atmospheric pressure on our earth. Hence we see that at extremely low pressure the rate of propagation of odors due to diffusion alone is far above any possible rate of propagation at atmospheric pressure. The graph of this increasing rate of propagation with decreasing pressure must approximate a regular curve with a positive slope. Therefore, we must conclude that the rate of propagation of odors on Mars, since the atmospheric pressure there is less than the atmospheric presssure on the earth, must be greater than the rate of propagation of similar odors on the earth.

As for "A Brickbat" from Mr. Milton White, I might say that nearly fifty per cent. of the articles in any scientific magazine that I may pick up contains ideas that I have seen presented elsewhere. I dare say that not one such article in a hundred contains absolutely new ideas, but that is no fault of the magazines or of the writer. Indeed if we confined our scientific magazine to strictly new ideas, we should have no scientific magazines. However, the old ideas, with new applications of them, must be submitted to the thinking persons in order to foster scientific thought on the still further new application of them.

The letter from Mr. E. H. Betts is very interesting, but it can scarcely be said that his premises are tenable or that his reasoning is logical. His comparison of the sun to a ball of burning coal is absurd, not because, as he suggests, that a ball of coal that size would be soon consumed (by what he would have it consumed I know not, for it would require two and one half times as much oxygen by weight as there was of the coal to consume it. But oxygen is less abundant in the sun than hydrogen and, therefore, if combustion were possible on the sun, the oxygen would all combine with hydrogen to form water. If the hypothetical coal were forced to combine with the excess of hydrogen it would require the exertion of energy rather than the release of energy), but because of the fact that the condition of temperature on the sun (about 6,000 degrees centigrade makes all compounds unstable and, therefore, all matter on the sun must exist as elementary substances in gaseous form. Hence, as Mr. Betts wisely concludes, the source of the sun's heat cannot be combustion. What the source really is remains a mystery, but several logical theories have been advanced. One theory is that the enormous internal pressure of the sun is causing a gradual decrease in the volume of the sun, but at the same time, according to the laws of isothermal compression, the sun is able to keep a constant temperature while constantly radiating heat. Another theory is that, under the enormous temperature and presssure within the sun, matter is actually being transformed into energy.

Be that as it may, we are practically assured that the sun is, has been for millions of years, and for millions of years to come will continue to radiate energy in the form of electro-magnetic waves of a wide range of wave-lengths. Among these are those rays of such wave-lengths that they are visible, others of such wave-lengths that their energy is transferred into molecular heat energy upon their impact with matter which is opaque to them, and still others that are not naturally perceptible to man. The method of propagation of these radiations is not yet known, but much is known of their nature. In this discussion we are interested in those radiations known as radiant heat or heat rays, but let us remember that the only difference between them and the other electro-magnetic waves, from the longest radio waves to the shortest X-ray, is a matter of wave-length. The velocity (en Vacuo) of all electro-magnetic waves of all wave-lengths is the same. It is the difference of wave-length that causes the different effect upon matter.

To Mr. Betts' second assumption I would reply that the hypothetical lumniferous ether has never been supposed to be gaseous by the leading physicists, but rather to be an elastic solid, or to be structureless, or to be of an electrical nature. However, there are a number of prominent physicists of the day who hold that the hypothesis of the cosmic ether is not necessary for the complete explanation of the known phenomena of electro-magnetic radiations. Of course the temperature of interstellar space is far more than 100 below zero, but that does not cause absorption of the sun's radiations. True, a small part of the heat that we experience is a result of the transformation of radiant heat into molecular heat by the impact of the heat rays upon the molecules of the atmosphere, but most of the radiant heat received by the earth is not transformed into molecular heat until it strikes the actual solid surface of the earth. This impact of the heat rays upon molecules of matter produce increases of molecular motion which we recognize as heat.

As for Mr. Betts' third item, I shall say that, since the sun is composed of a mass of incandescent gases, is such a large body compared to the earth, and contains such enormous internal energy

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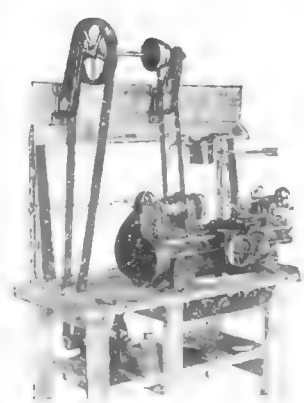

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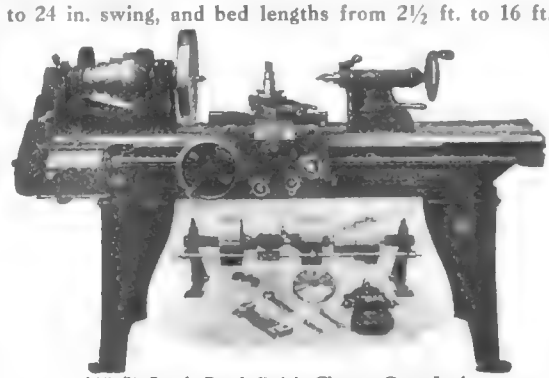

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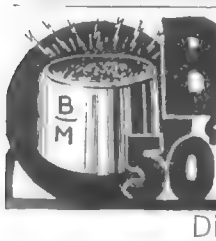

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it is not at all unreasonable to believe that some great eruption at the surface of the sun might throw out streams of incandescent gases (not flames as Mr. Betts suggests), hundreds of thousands of miles.

Mr. Betts' fourth statement is very nearly correct. In addition to its electro-magnetic radiations, the sun probably gives electrons. The Aurora Borealis are probably caused by the impact of an electronic discharge from the sun upon solid particles of nitrogen in the upper strata of the atmosphere.

To Mr. Betts' fifth assumption I take exception, for there is both evidence and proof of the presence of molecular heat on the moon, though, as he says our satellite has little or no atmosphere. Indeed, if there were no heat on the moon, it would actually cease to exist, for all indications lead us to believe that, if a temperature of absolute zero were obtained in the presence of matter, the molecular structure of that matter would collapse and it would cease to exist as matter as we recognize it.

No, the sun's source of energy is not radium, and yet it may be more similar to dissociation of radium than we realize. Of course the sun is an electrical body, as Mr. Betts hazards, but it is an electrical body for the simple reason that all matter is electricity.

I also find some errors and some very doubtful statements in the quotations from Mr. H. Gernsback's "Editorial," which is appended to Mr. Betts' letter. First, I question the statement that interplanetary and interstellar space is an absolute vacuum. We say that all gases tend to expand definitely, and we know that many molecules of the lighter gases are continually escaping from the gravitational influence of all the heavenly bodies. Then, is it not reasonable to believe that these escaping gases fill infinite space, however rarified they may be? And if Mr. Gernsback is right in his theory of the absolute vacuum, then the temperature of interstellar space is —273 degrees Centigrade or absolute zero, but if there be any matter however rare, in the interstellar space, then the temperature is not absolute zero however near it may approach the value.

It is true that heat cannot be propagated in a vacuum by conduction or convection, but it certainly can be propagated in as complete a vacuum as interstellar space by means of radiation. Mr. Gernsback failed to state that the walls of the thermos bottle are silvered to prevent the loss of heat by radiation, since the vacuum would not diminish that loss. Mr. Gernsback states, "Heat proper cannot flow between these bodies (the earth and the sun) immersed in a perfect (?) vacuum and besides separated some 92 million miles. So we see that, we do not and cannot receive radiant heat rays from the sun." But I say that we can and most certainly do receive radiant heat rays from the sun, and that is the only present source of heat on the earth, other than chemical energy which originally came from the sun.

Incidentally, I might say that molecular heat (if that is what Mr. Gernsback means by heat proper), does not flow, but is transmitted by the impact of one molecule upon another. Also I object to the statement that meteors enter our atmosphere at a temperature of absolute zero. Although they may approach that temperature as a limit, they can never reach it as long as they exist as matter.

L. C. Cartwright, *Reporter No. 9656.*
University of Florida, Gainsville, Fla.

(After reading the above letter, there is very little left for us to say. Mr. Cartwright seems to have covered the ground quite thoroughly, and conscientiously. It seems that the majority of votes are in favor of "A Medico" who sent a letter to the Readers' Forum which was published in the September issue of Science and Invention, *in which he disputed the statements made in the August issue as to the reason why Martians have a long nose. This opinion was given by Mr. H. Gernsback who held that the scant atmosphere on Mars made it difficult to smell, and the odors were propagated at a slower speed due to this attenuated atmosphere. In the statement quoting Mr. Gernsback's editorial, relative to radiant heat rays from the sun, Mr. Cartwright seems again correct. The only heat energy which we receive from the sun is radiant heat rays. Through some error the word radiant was substituted for the ordinary effect of heat, which is conveyed to our senses by the physical phenomena known to us as conduction and convection.*

There is great question as to whether the interstellar space possesses an absolute vacuum or contains a rarified gas, the molecules of which gas are separated greatly. It would seem that if rarified gas were to be found in interstellar space, there would be a considerable slowing up of the planets. There is no reason to presuppose for one moment that if rarified gas is present that a portion of that gas would not contain molecules of oxygen, and containing molecules of oxygen, interstellar space should support combustion. The writer is inclined to the belief that interstellar space holds nothing but an almost perfect vacuum. Why the temperature should be minus 273 degrees Centigrade simply because the space contains a vacuum is not very clear. There may be particles of micro cosmic dust in space which would raise the temperature considerably above absolute zero. Of course this micro cosmic dust would also tend to slow up the planets at least to the same extent that air would.—Editor.)

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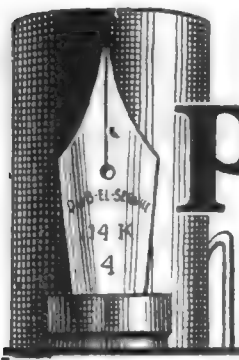

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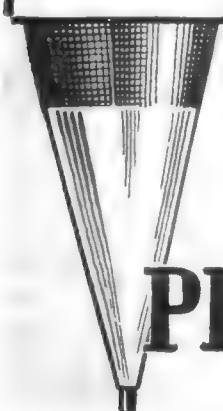

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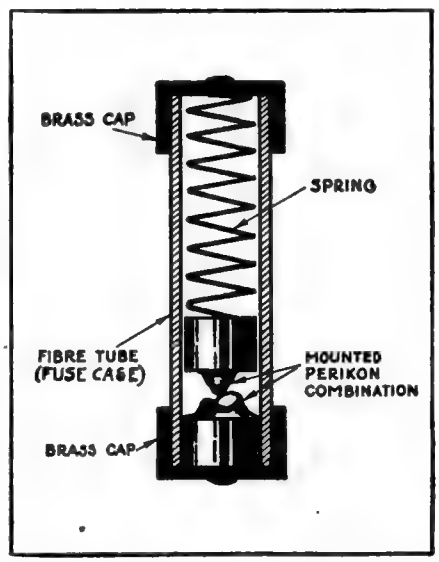

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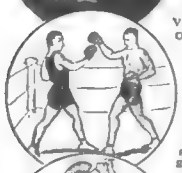

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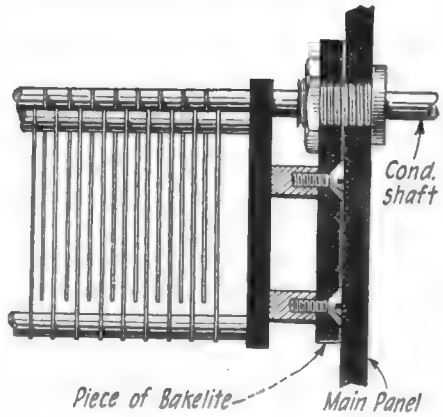
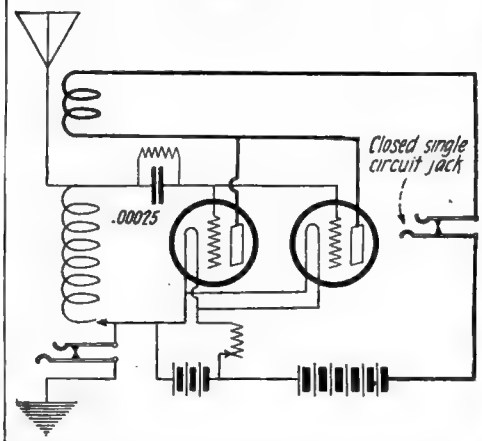


A simple and quick way for mounting condensers is to use a one hole support. A small sub-panel is used in this connection and the instrument becomes adaptable for use much more quickly than could be realized in any other way.

—G. A. Coates, Reporter No. 12052.

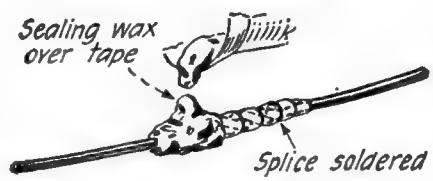
RECEIVER TRANSMITTER



The single circuit regenerative set shown, employing two tubes combines a long distance receiver and low power transmitter. When transmitting, the phones are removed from the circuit and a key or microphone inserted in the ground lead.

—T. C. Clements, Reporter No. 13231.

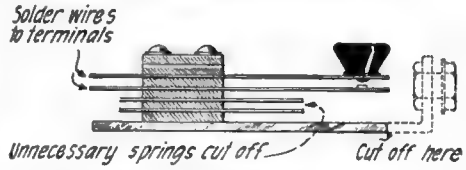
PERFECT CONNECTIONS



In the splicing of antenna wire, the joint is thoroughly cleaned and soldered. It is then carefully taped and melted sealing wax poured over the whole. This joint is impervious to the elements.

—V. Ustach, Reporter No. 8065.

KEY FROM PHONE JACK



A very efficient telegraph key can be made from an old phone jack by a few simple alterations. When completed, the key may be used on a telegraph set, a test buzzer or other signalling device which requires the use of but a small amount of current.

—H. C. Rowe, Jr., Reporter No. 37.

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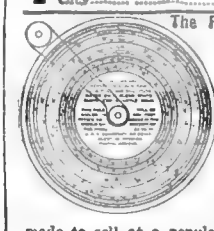

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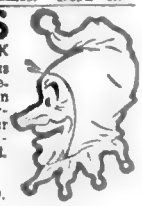

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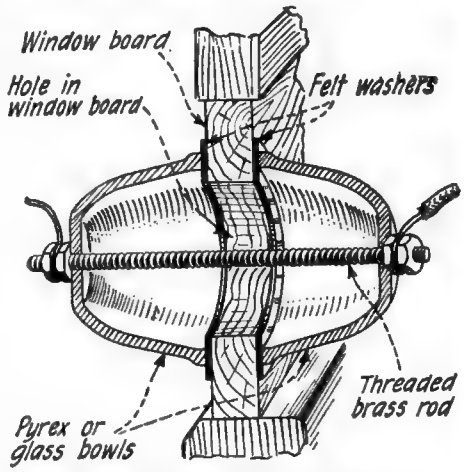
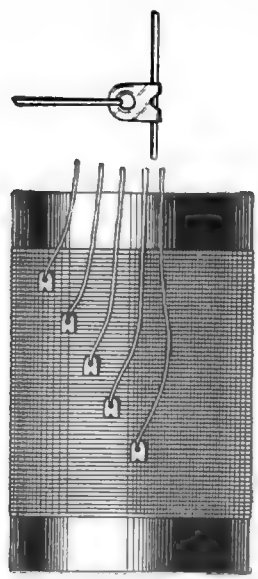


A large hole is drilled in the window board and two pyrex or glass bowls are held together by means of a threaded brass rod passing through holes drilled in the bottom of each. For further information on how to drill glass, the reader is referred to page 49 of the May issue of SCIENCE AND INVENTION.

—G. A. Coates, Reporter No. 12052.

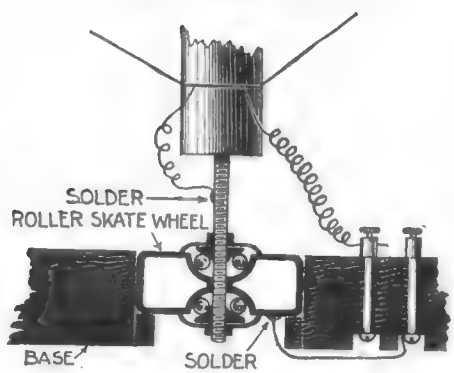
PAPER FASTENER KINK



Paper fasteners may be attached to tap leads so that the necessity of soldering may be done away with. If so desired, the taps may be taken off before winding the inductance, so as to allow soldering without burning the insulation off the wire.

—Leighton Powell, Reporter No. 8620.

LOOP AERIAL BEARING



A very good support for the loop antenna is made from the wheel of a ball bearing roller skate. This allows of a neat and efficient bearing which requires little effort to turn and takes up very little space.—W. F. Bloom.

(Continued on page 849)

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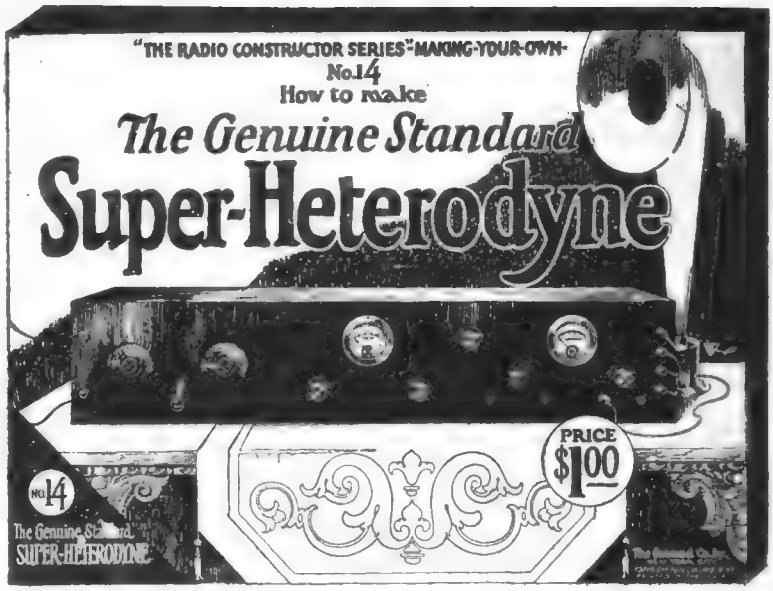

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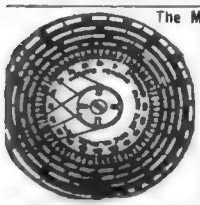

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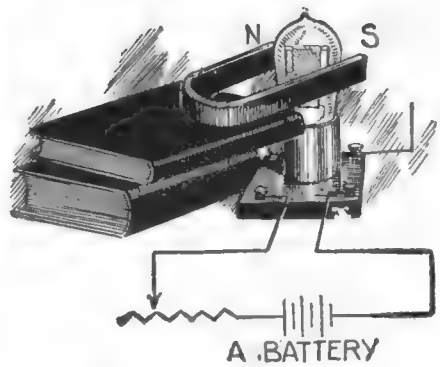
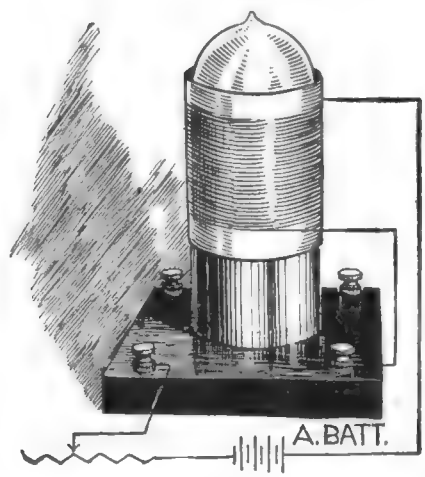
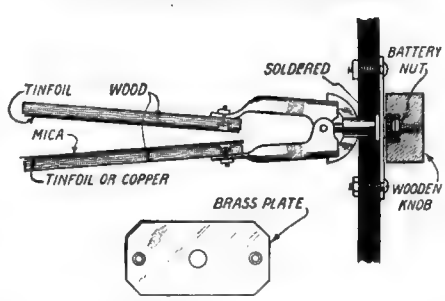
SIGNAL INTENSIFIER





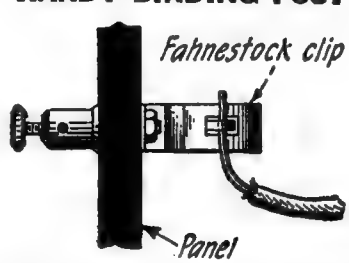
Soft detector tubes sometimes work very well if a permanent magnet is placed near them, but this is dangerous practice. A slight movement of the magnet and we may be minus a tube. Twenty-five turns of No. 26 S. C. C. wound on a cardboard tube and connected in series with the "A" battery supply gives a much better arrangement.
—Ernest Oliver, Reporter No. 13314.

A VARIABLE CONDENSER



A fairly good type of variable condenser is readily made by using a discarded compass and fitting it as shown in the above diagram. Extremely fine adjustment can be had.
—David Jenkins.

HANDY BINDING POST



For quickly changing wires to binding posts when experimenting, the combination shown, consisting of Fahnstock clip and binding post serves to save much time and trouble.
—Kenneth Stewart, Reporter No. 13593.

(*Continued on page* 851)

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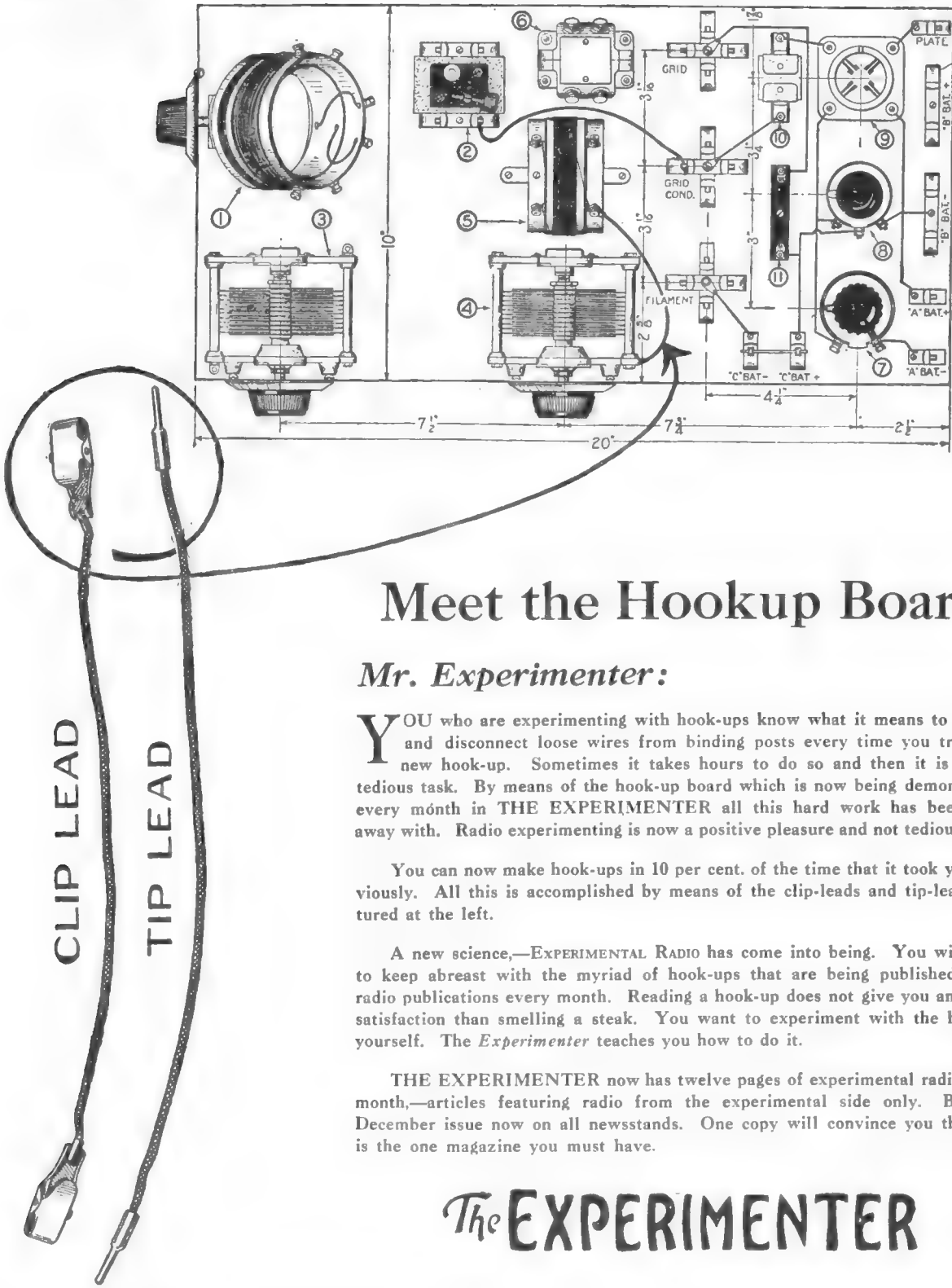

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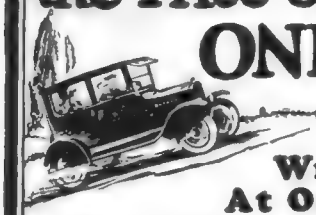

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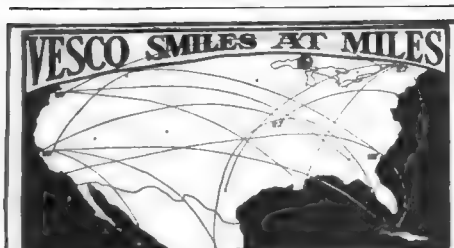

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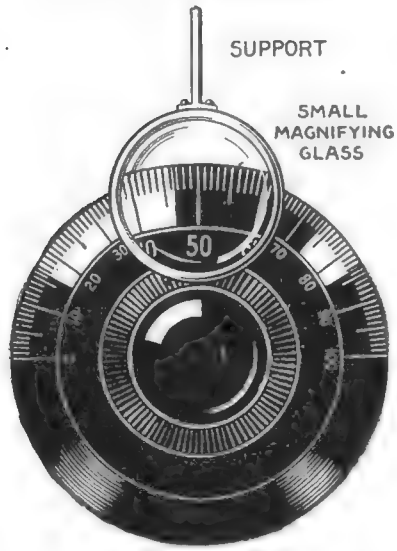

By using a small magnifying glass attached to the panel and directly over the scale of a dial, the numbers and marks can be seen much better, thus aiding in sharper tuning. Old people who cannot see very well will welcome this as a worthy suggestion.
—Claude Lisman.

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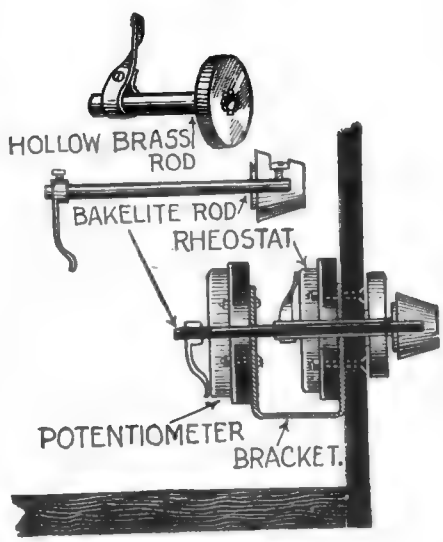

A potentiometer and a rheostat, or even two rheostats alone, may successfully be combined into one unit. The result is a conservation of space and a distinctive outstanding appearance. —Tud Garver.

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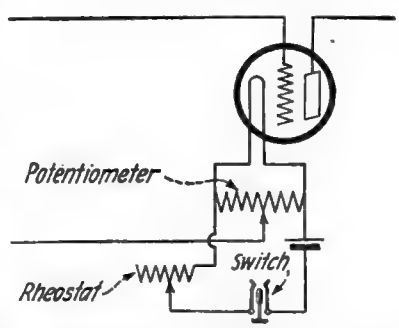

Circuits employing potentiometers must be so connected as to alleviate any slow leak across the various batteries. The right way to connect the potentiometer is shown in the diagram. —Kingsley Peck.

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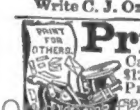

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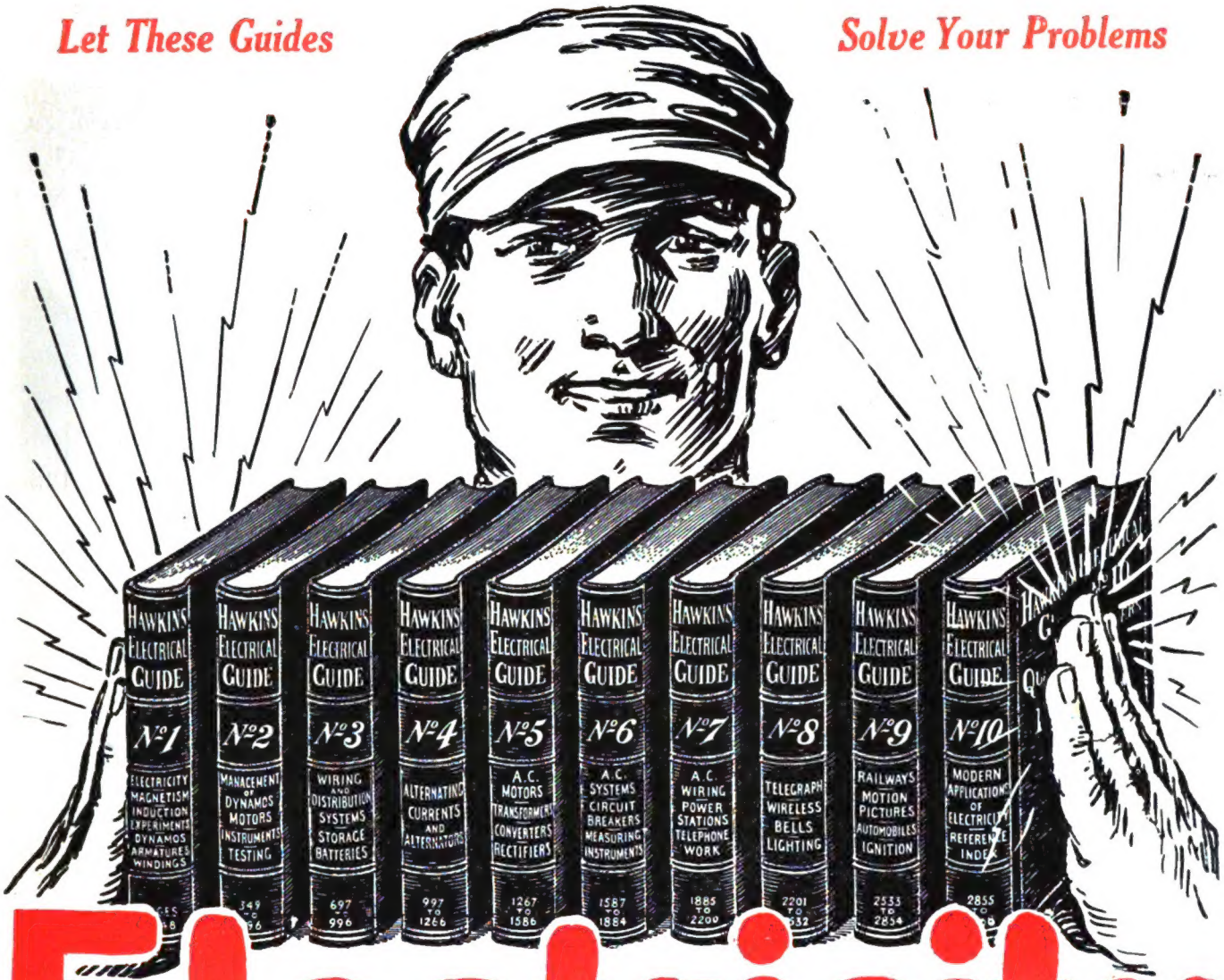

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